UNIVERSIDADE DE LISBOA

FACULDADE DE CIÊNCIAS

DEPARTAMENTO DE BIOLOGIA ANIMAL

Adapting a comprehensive behavioural model to investigate drivers of illegal sea turtle trade

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Mestrado em Biologia da Conservação

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2020

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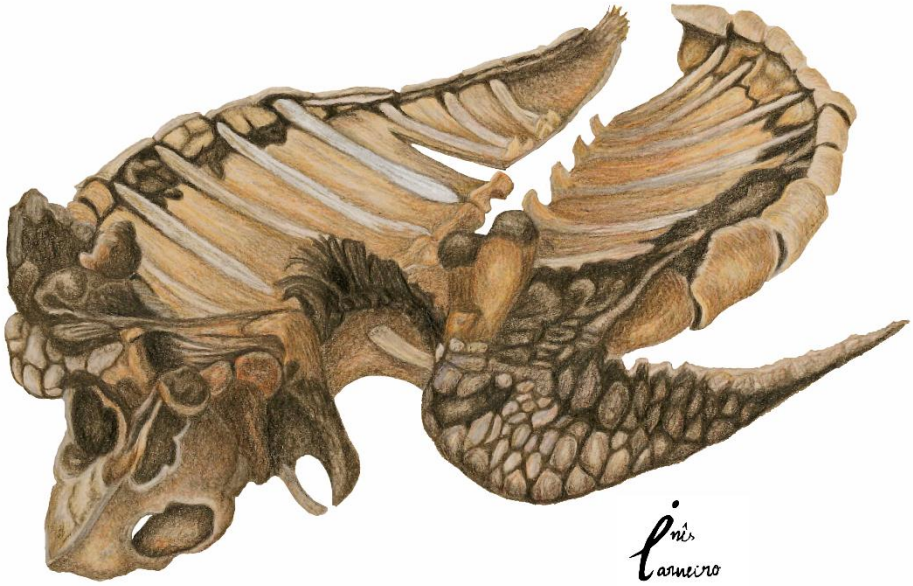
Inês Carneiro

ACKNOWLEDGEMENTS

I would first like to offer my gratitude to the Maio Biodiversity Foundation for granting me the opportunity to conduct this research, and providing logistical support on Maio island, as only through them was this dissertation made possible. Funding support came from MAVA Fondation pour la Nature and NOAA USFWS.

Special thanks must be accorded to both my outstanding supervisors, Ana and Alexandra. I will likely always be indebted to Ana for expanding my understandings and horizons regarding conservation social science, through her constant advice and unwavering good will. I also greatly appreciate Alexandra's support, who although not being familiar with me beforehand, welcomed me into her cosy student group while always being receptive, kind and attentive. Throughout my university years countless colleagues have lamented their misfortunate choices of supervisor; I will never be able to do the same myself.

From the FMB staff itself, I much appreciate all the assistance and advice provided by Juan during my stay and his keen interest in my work. Likewise, thank you to Raquel for the valuable inputs given towards the methodology. I thank the entire team for their friendliness, especially Andreia for her continued consultation, Lando for his good spirit, and Sara for her obliging help. Considerable credit needs to be given to Inês Mota for her energy and assistance in the field. I should also recognize the community leaders for facilitating my fieldwork: Patricia, Delvany, Natalicio, Kitxe, Klush, Lino, Martim, Noc, Nhelas, Edinho, as well as Jairson and Leno. The Homestay women who welcomed me into their homes also deserve to be mentioned, particularly Vanda, Filomena, Albertina and Dulceneia.

As a community, Pedro Vaz was invaluable in providing me a warm welcome and making me feel at home. I shall never forget Tata, Toto, Joceneia, Liana, Pedro and Pirata for their unending hospitality and whole-hearted affection. As briefly as possible, I would be remiss if I did not thank Mamã Filipa, Djadje, Juvino, Alexandre, Don, Ti, Edelaine, Urbano, Sabinha, Carlins, Odete, Keusa, the two Rubens, Joanito, Marina, Robitson, Alvino, and all other friends from PV. Further thanks to the Portuguese volunteers for their companionship, notably Raquel, Carolina, João and Roger Pelarto.

Lastly, I refer to my family, that have accompanied my academic endeavours since they began. A very distinguished thank you is given to Inês Carneiro, who has shaped my work in countless ways, dispensed precious opinions, aided me in the field and encouraged me every step of the way. To my parents, no words exist that would suffice to express my deepest gratitude for your love and support, I just hope I can someday repay you. Don't raise your hopes up for much money though – after all, I've chosen to be a biologist.

RESUMO

O paradigma atual da biologia da conservação reconhece a importância da inclusão da vertente das ciências sociais no planeamento, gestão e avaliação de medidas de conservação. A sua integração deixou de ser apenas um complemento e tornou-se numa componente vital de intervenções eficazes e duradouras. No entanto, na prática estas recomendações não se tendem a concretizar e estão longe de ser normalizadas. Incorporar estas áreas de conhecimento científico é profundamente relevante, dado que muitas das ameaças à biodiversidade do planeta derivam de processos sociais, económicos e políticos. Embora muitos destes desafios envolvam soluções multifacetadas a escalas regionais, nacionais ou globais, os seus desfechos dependem frequentemente da compreensão e alteração de comportamentos humanos. Tal é o caso do comércio ilegal de animais, que alberga diversas práticas proibidas que comprometem a conservação de milhares de espécies de fauna e flora, tais como a apanha, transporte, compra e venda de animais selvagens. Estes comportamentos são complexos, heterogéneos, alteram-se rapidamente e são altamente específicos às suas regiões geográficas; compreender minuciosamente as suas dinâmicas requer a aplicação de conhecimentos e ferramentas de ciências sociais, nomeadamente da psicologia da conservação. Aproveitando fundamentos da psicologica social, a psicologia da conservação pretende estudar como as pessoas interagem com a biodiversidade e como promover comportamentos sustentáveis e favoráveis à conservação. No entanto, teorias comportamentais coerentes e inclusivas têm recebido pouca atenção em contextos de conservação, especialmente quando comparado com as áreas de saúde pública, bem-estar, economia e utilização de recursos. Existe uma multiplicidade de modelos que analisam quais os fatores determinantes nos comportamentos humanos. Agregando de modo parsimonioso três das teorias mais utilizadas em psicologia ambiental, o Modelo de Determinação de Ação Abrangente (*Comprehensive Action Determination Model*) foi recentemente proposto como uma estrutura concetual holística e flexível. No entanto, ao ser desenvolvido num domínio diferente, este modelo pode não ser aplicável ao estudo dos comportamentos ilícitos e altamente contextuais, característicos do comércio ilegal de animais. Assim sendo, seria profundamente vantajoso comprovar a validade desta ferramenta e empregá-la no âmbito da psicologia da conservação.

Usando o comércio ilegal de tartarugas marinhas que tem persistido na ilha do Maio em Cabo Verde como caso de estudo, este trabalho visa compreender quais os fatores decisivos no consumo e apanha ilegal destas espécies na área de estudo, empregando métodos mistos, i.e., análise qualitativa de dados e o Modelo de Determinação de Ação Abrangente. Para isto, foi feita inicialmente (1) a caracterização dos contextos gerais do consumo e apanha de tartaruga no passado e no presente, investigando as suas práticas, motivações, barreiras e aspectos culturais através de entrevistas semi-estruturadas (análise qualitativa). De seguida, (2) averiguaram-se quais os fatores que potencialmente influenciam o consumo de tartarugas na ilha do Maio no passado e no presente, adaptando o Modelo de Determinação de Ação Abrangente. Colocou-se a hipótese que as variáveis psicológicas incluidas no modelo explicariam significativamente esse consumo, o que implicaria a sua adequabilidade a outras situações de conservação de tartarugas marinhas, e possivelmente ao comércio ilegal de animais no geral.

A ilha do Maio pertence ao arquipélago de Cabo Verde, uma região imprescindível à nidificação de tartarugas-comuns (*Caretta caretta*) no Atlântico Este, dado que o país acolhe a terceira maior agregação de ninhos desta espécie no mundo. Apesar de um aumento nos esforços de conservação na ilha nos últimos anos, o comércio ilegal de tartarugas continua a ocorrer clandestinamente em diferentes comunidades. Um total de vinte entrevistas individuais e de grupo foram feitas em todas as comunidades da ilha, para elucidar a apanha e consumo de tartarugas tanto no passado como no presente. Dez entrevistas individuais acerca da apanha foram dirigidas a homens ex-apanhadores, e dez entrevistas de grupo sobre consumo foram aplicadas a mulheres. Estes métodos não só geraram o seu próprio leque de resultados como também serviram para informar o planeamento da fase seguinte – a administração de questionários em toda a ilha (N = 325) sobre quais variáveis do modelo concetual suscitaram intenção de consumir carne de tartaruga no passado e presente.

Dados das entrevistas semi-estruturadas indicaram que no passado a população inteira, salvo raras exceções, participava no consumo de tartarugas, enquanto que a apanha era realizada quase exclusivamente pelos homens. Nenhum consenso foi encontrado sobre quando começou a proteção de tartarugas, mas os participantes reconheceram, unanimemente, que aumentou drasticamente após as intervenções de uma organização não governamental local e da criminalização do comércio de tartarugas em 2017. No passado, tanto o consumo como a apanha destes animais foram associados pelos participantes a diversas motivações, mas a nenhum impedimento; o consumo era estimulado principalmente pelo sabor apreciado da carne de tartaruga e pela pobreza/falta de alimento; a apanha era incentivada pela vontade de consumir, mas também para trocar a carne obtida com vizinhos por outros alimentos, levando ao que os participantes denominaram como "uma casa cheia". Actualmente, ambos os comportamentos têm tanto motivações como impedimentos. Os participantes reconheceram que o sabor da carne continua a provocar o seu consumo, mais do que qualquer outro motivo. A apanha surge agora ligada à venda de produtos provenientes de tartarugas, maioritariamente carne mas também carapaças e pénis. A apanha foi por isso geralmente atribuida a homens mais jovens, desempregados e/ou que apresentam comportamentos de dependência a substâncias como drogas ou álcool. Obstáculos a ambos os comportamentos coincidiram: os principais foram o receio de sofrerem consequências legais e o facto de várias profissões dependerem, direta e indiretamente , da conservação de tartarugas para o seu sustento; os secundários consistiram em remorsos e restrições religiosas. No que se refere à aplicação do modelo, a variável "atitudes" foi o único fator psicológico que influenciou a intenção de consumir tartarugas, no passado e no presente. As médias das atitudes e intenções de consumir sofreram alterações significativas ao longo do tempo. Estas variações foram parcialmente moderadas pelo tamanho do agregado familiar e localização geográfica da comunidade na ilha.

Os resultados obtidos sugerem que consumo e apanha de tartarugas têm sido sempre impulsionados por atitudes. Triangulando dados qualitativos e quantitativos, as atitudes parecem ser uma componente vital de consumo de tartaruga. Algumas das principais motivações descritas pelos participantes esclareceram diferentes aspectos destas atitudes. Apesar de apenas ser abordada numa perspetiva qualitativa, através de entrevistas semi-estruturadas, relatos sobre a apanha apontaram para uma importância semelhante de atitudes neste tipo de comportamento. No entanto, para além de atitudes, outras variáveis poderão ter tido – ou vir a ter – efeitos relevantes nos comportamentos de apanha e consumo de tartaruga. De destacar, é possível que a perceção de controlo comportamental esteja a influenciar diretamente o consumo e apanha de tartarugas, não mediado por intenção, o que seria uma relação difícil de detetar neste trabalho. Mais, eventuais intervenções de conservação poderão tentar fortalecer normas pessoais e sociais identificadas pelos participantes, mas pouco acentuadas. Campanhas de conservação subsequentes na ilha do Maio devem ser planeadas cuidadosamente tendo em atenção a gama de motivações, impedimentos e fatores psicológicos apresentados neste trabalho, para estimular mudanças comportamentais de forma competente e duradoura. Isto é particularmente importante na medida em que muitos dos participantes revelaram crenças benéficas em relação à conservação de tartarugas baseadas em informação falsa. Vários participantes descreveram como atualmente o sabor de tartarugas é menos apreciado devido a serem injetadas com medicamentos ou criadas em laboratório/cativeiro, ambas alegações incorretas. Neste sentido, as entidades responsáveis por medidas de conservação na ilha devem tomar precauções para não desmascararem inadvertidamente estes valores, prejudicando as suas metas. Seria também prudente usar este conjunto de dados psicológicos como uma base para futuras avaliações.

Finalmente, o Modelo de Determinação de Ação Abrangente revelou-se uma ferramenta apropriada para estudar um comportamento específico a uma situação de comércio ilegal de tartarugas marinhas. Semelhante ao que se verificou em estudos anteriores, a sua estrutura abrangente permite alterar facilmente certos fatores para ajustar o modelo a diferentes contextos. Isto poderá denotar a sua aplicabilidade a outras problemáticas semelhantes de comércio ilegal de animais, ou mesmo de

conservação em geral. A aplicação do modelo neste estudo também contribui para demonstrar como teorias baseadas em áreas de interação com as ciências sociais podem transladar-se para a psicologia da conservação. A investigação em biologia da conservação deve continuar a expandir o leque de instrumentos interdisciplinares ao seu dispôr, nomeadamente, explorando modelos comportamentais já desenvolvidos noutras áreas científicas, que possam ser relevantes aos objectivos da conservação.

Palavras-chave: Cabo Verde, comércio ilegal de animais, conservação de tartarugas marinhas, métodos mistos, psicologia da conservação

ABSTRACT

Successful conservation outcomes often depend on engaging with human communities and influencing behaviours that negatively impact biodiversity. Illegal wildlife trade illustrates this, as individual behaviours such as animal harvesting and consumption threaten global conservation goals. Inclusive psychology models that examine what motivates and deters behaviours have been substantially applied in other scientific fields, but are currently underutilised in illegal wildlife trade contexts. This research aims to understand the drivers of illegal harvesting and consumption of sea turtles on Maio island, Cabo Verde – where despite recent increased protection, nesting turtle populations continue to suffer from furtive trade. For this purpose, broad qualitative semi-structured interviews (N = 20) were combined with questionnaires (N = 325) centred on a comprehensive theoretical framework developed in environmental psychology. Behavioural motivations seem to have mostly changed over time, but some key beliefs remained intact such as the perceived pleasantness of meat. Structural equation modelling showed intention to consume turtle meat has always been considerably influenced by attitudes. The same is likely true for harvesting, nowadays reportedly performed mostly by young men looking to profit from selling turtle by-products. Beliefs underlying both behaviours are fairly different, so outreach should carefully and specifically address each one. Study participants made insightful comments regarding the perceived difficulty of these behaviours, its accompanying guilt, and religious impediments regarding consumption. By incorporating this information, prospective management efforts may therefore benefit from weakening perceived behavioural control and establishing new moral and social norms. Long-term socio-ecological assessments tend to be limited or inadequate in conservation programmes, so local research should treat this study as a baseline of knowledge for future evaluations. In all, results further demonstrate how broader, more encompassing conceptual models developed in other scientific domains can be adapted to conservation issues, therefore expanding the interdisciplinary methods available to practitioners. Continuing to embrace and improve these tools is crucial towards addressing the socially intricate and contextual behaviours found in illegal wildlife trade.

Keywords: Cabo Verde, conservation psychology, mixed methods, sea turtle conservation, wildlife trade

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ATT	Attitudes
CADM	Comprehensive action determination model
CFA	Confirmatory factor analysis
CFI	Comparative fit index
CVE	Cabo Verde escudo
Df	Degrees of freedom
FMB	Maio Biodiversity Foundation
INT	Intention
IWT	Illegal wildlife trade
LGM	Latent growth model
MLR	Maximum likelihood robust (estimation)
NGO	Nongovernmental organisation
PBC	Perceived behavioural control
RMSEA	Root mean square error of approximation
SDG	Sustainable development goals
SEM	Structural equation modeling
SRMR	Standardized root mean residual
TLI	Tucker Lewis index
USD	United States dollar

GENERAL INTRODUCTION

Importance of social sciences in conservation

Within the broad field of conservation, policies and practices have historically been based largely on information gained through natural science expertise (Bennett et al. 2017). However, conservation actions tend to occur in populated landscapes and seascapes (Bennett et al. 2019), so that many of its most urgent challenges stem from human dimensions (Venter et al. 2016). The indispensable importance of social sciences – needed to understand social, economic and political challenges – has been increasingly recognized by conservationists, and calls for interdisciplinary research are now abundant (Bennett et al. 2016; Bennett et al. 2017; Rust et al. 2017; Teel et al. 2018). And yet, widespread adoption of conservation social sciences still faces various challenges. For example, rigorous, theory-based methodologies are often not embedded in the several stages of conservation management (Bennett et al. 2016); practitioners frequently lack the knowledge to effectively engage with social sciences (Newing et al. 2011; Bennett et al. 2017; Moon et al. 2019); and researchers' interests may align more with ecological aspects of conservation rather than human ones (Madden and McQuinn 2014). Despite these barriers, interest in conservation social sciences is increasing considerably. Current research is focusing on how to overcome these academic gaps, which structures should be implemented to encourage broader interdisciplinarity, and how to incorporate lessons from other fields (Wallen 2017; Maas et al. 2019). Hopefully, the following years may represent a turning point in mainstreaming conservation social sciences (Maas et al. 2019).

Threats and impacts of illegal wildlife trade

Illegal wildlife trade (IWT) is a multidimensional, complex conservation issue involving numerous stakeholder groups, large geographic ranges and many different types of trade dynamics (Roberts and Hinsley 2020). It has become a major global policy concern in recent years due to its negative impacts on thousands of trafficked species (Esmail et al. 2020). IWT can be defined as the unlawful practices connected to commercial exploitation of wild species of fauna, flora and fungi; these include activities related to harvesting, transportation, commercial exchanges and end usage of wildlife and their products, from regional to international scales ('t Sas-Rolfes et al. 2019). Renewed interest in this area has surged over the past decade, prompted by increased unsustainable exploitation of prominent threatened taxa throughout the world ('t Sas-Rolfes et al. 2019). However, IWT is an intricate and heterogeneous issue that has both positive and negative impacts on UN Sustainable Development Goals (SDGs; Biermann et al. 2017; Milner-Gulland et al. 2018). For example, IWT often threatens life below water (SDG 15), life on land (SDG 16) and public health and well-being (SDG 3) through zoonotic diseases, but may simultaneously reduce poverty (SDG 1), prevent hunger (SDG 2) and provide decent work (SDG 8; Booth et al. 2020). So far, the dominating approach has been to enforce stronger regulations that control IWT ('t Sas-Rolfes et al. 2019, Roberts and Hinsley 2020), but strict and socially illegitimate management can result in non-compliance (Bonwitt et al. 2018; Oyanedel et al. 2020). The absence of insightful and evidence-based understandings of the relevant social landscapes can lead to counterproductive outcomes for wildlife and people (Milner-Gulland et al. 2018).

Recently, there has been a growing interest in tackling IWT by focusing on reducing consumer demand for wildlife products (Veríssimo and Wan 2018; Veríssimo et al. 2020). When referring to local or regional wildlife markets, supply chains are frequently relatively simple and comprise only a few actors ('t Sas-Rolfes et al. 2019). At this micro level, conservation campaigns can stimulate realistic changes to locally specific behaviours (Milner-Gulland et al. 2018). However, such initiatives require comprehending target audiences, important motivations and obstacles, existing beliefs or perceptions, and much more (Veríssimo and Wan 2018). To this end, IWT behaviours have been researched using methodologies from several fields, of which social psychology approaches have come to the fore (Veríssimo 2013). Future research should focus on building coherent behaviour change strategies that are subject to rigorous impact evaluation ('t Sas-Rolfes et al. 2019).

Conservation psychology and common behavioural theories

Using lessons from psychological sciences, conservation psychology was established to comprehend the ways in which people behave towards the environment and simultaneously promote sustainable and pro-conservation behaviours (Clayton and Brook 2005; Clayton and Myers 2009). It developed as a branch of environmental psychology, which studies interactions between people and their surrounding environments, natural or otherwise (Selinske et al. 2018). Conservation psychology has contributed to shaping socially acceptable management actions, anticipating social conflict, and advising marketing strategies (Bennett et al. 2017; Green et al. 2019). Despite a relative increase in its research over recent years, coherent and comprehensive frameworks that investigate behaviours impacting wildlife have been somewhat scarcely applied in conservation (St John et al. 2010; Selinske et al. 2018; Nilsson et al. 2020). Contrastingly, dozens of psychology models have been successfully implemented in other domains, most notably public health, wellbeing, economy and resource usage (St John et al. 2010; Davis et al. 2015).

Within environmental psychology, three of the most commonly used behaviour models are the Theory of Planned Behaviour, the Norm Activation Theory and the Value Belief Norm Theory, which by embracing divergent approaches to predicting behaviours possess different benefits and drawbacks. The Theory of Planned Behaviour asserts behaviours are guided by three considerations: beliefs about favourable or unfavourable consequences (attitudes); normative expectations and social pressure (social norms); and the perceived ability a person has to perform the behaviour (perceived behavioural control). These three factors exert influence over the intention to perform a behaviour, which in turn is the immediate antecedent of overt behaviour (although perceived behavioural control also has a direct effect on behaviour; Kaiser et al. 2005; Ajzen 2006). Various interpretations of the Norm Activation Theory exist, yet all present a model for prosocial decision making in moral situations, based essentially on: the moral obligation to act a certain way (personal norms); awareness of the negative outcomes for others if action is not taken (awareness of consequences); and feeling responsible for those negative outcomes (ascription of responsibility; De Groot and Steg 2009). The Value Belief Norm Theory also relies on these three factors, but links them into a causal chain, while further adding the importance of a person's ecological worldview (Oreg and Katz-Gerro 2006; Harland et al. 2007). More detailed information regarding these three models and their application in environmental contexts can be found in Kaiser et al. (2005) and De Groot and Steg (2009).

The Theory of Planned Behaviour is a general behaviour theory that has received strong empirical backing, but underrepresents the effects of morality; by contrast, the Norm Activation Theory and Value Belief Norm Theory are designed to study altruistic and personal obligations that influence behaviours, but ignore all non-moral motivations (Klöckner and Blöbaum 2010). As a result, the Comprehensive Action Determination Model (CADM) was presented as a unifying framework that seeks to minimize the drawbacks found in each individual model while profiting from their advantages (Klöckner 2013). It is yet to be applied in any conservation context, but as an inclusive behavioural framework may show promise in addressing current IWT challenges (Milner-Gulland 2018).

Successes and challenges in sea turtle conservation

As widely beloved species, sea turtles have garnered worldwide attention for decades, and are therefore an abundantly well researched taxon subject to a wide range of actions and initiatives (Rees et al. 2016). For centuries turtle populations suffered declines, caused largely by bycatch and harvesting adults/eggs, but many populations have now stabilized or increased (Mazaris et al. 2017). Small- and large-scale interventions have contributed to this success, including long-term beach protection, regulating fisheries, establishing marine protected areas and engaging local communities (Godley et al. 2020). In many countries, turtles are protected from local consumption or commercial trade by national legislation and international agreements (Mazaris et al. 2017). However, IWT of sea turtles and their products has persisted in numerous developing countries (Martins et al. 2012; Barrios-Garrido et al. 2019; Williams

et al. 2019; Veríssimo et al. 2020). This may be a result of limited understandings about social dimensions of sea turtle consumption, which is likely hindering management and legislative practices (Godley et al. 2020). Recent studies have progressed this knowledge gap (Hancock et al. 2016; Nuno et al. 2018; Barrios-Garrido et al. 2019; Veríssimo et al. 2020), but have not yet examined turtle trade through comprehensive psychological approaches. These would not only aid in understanding regional outcomes but could help inform broader scale practices (Rees et al. 2016).

Cabo Verde: a vital region for loggerhead sea turtles

Located 500 km from the western coast of Africa, the Cabo Verde archipelago consists of the third largest loggerhead turtle (*Caretta caretta*) nesting area in the world, after south-eastern US and Oman (Marco et al. 2012). Its islands hold over 95% of all loggerhead turtle nests in the entire eastern Atlantic (Marco et al. 2010; Marco et al. 2012). Nests were known to be located primarily on the islands of Boa Vista and Sal (Martins et al. 2012; Laloë et al. 2020), but recent data has confirmed Maio Island is of substantial importance, recording almost 8000 nests in 2019 (Martins et al. 2013; FMB pers. comm. 2020). Conservation actions have been undertaken to protect this loggerhead turtle population on all islands, by increasing and enforcing trade bans, monitoring beaches, raising general awareness and engaging with local communities (Direcção Nacional do Ambiente 2015). Sea turtle trade has, however, endured in several coastal communities, where meat, eggs and other derivatives continue to be used for various purposes (Martins et al. 2012; Martins et al. 2015; Hancock et al. 2016). Recommendations made in the wider sea turtle conservation literature likely apply here, as limited research has explored the social dimensions of illegal sea turtle trade in Cabo Verde (Hancock et al. 2016).

Research purpose and contribution

Following what has been presented so far, this study engages with goals on both a regional and an academic level (see thesis outline depicted in Figure GI.1). Regarding sea turtle conservation on Maio, it aims to provide a better understanding of illegal sea turtle trade behaviours and how they can be mitigated, by combining a behaviour model (CADM) with qualitative methods. On a theoretical level, it seeks to demonstrate how a comprehensive model developed in environmental psychology (CADM) can be transposed to conservation circumstances, thus expanding the interdisciplinary toolbox available to conservationists.

Adapting a comprehensive behavioural model to investigate drivers of illegal sea turtle trade

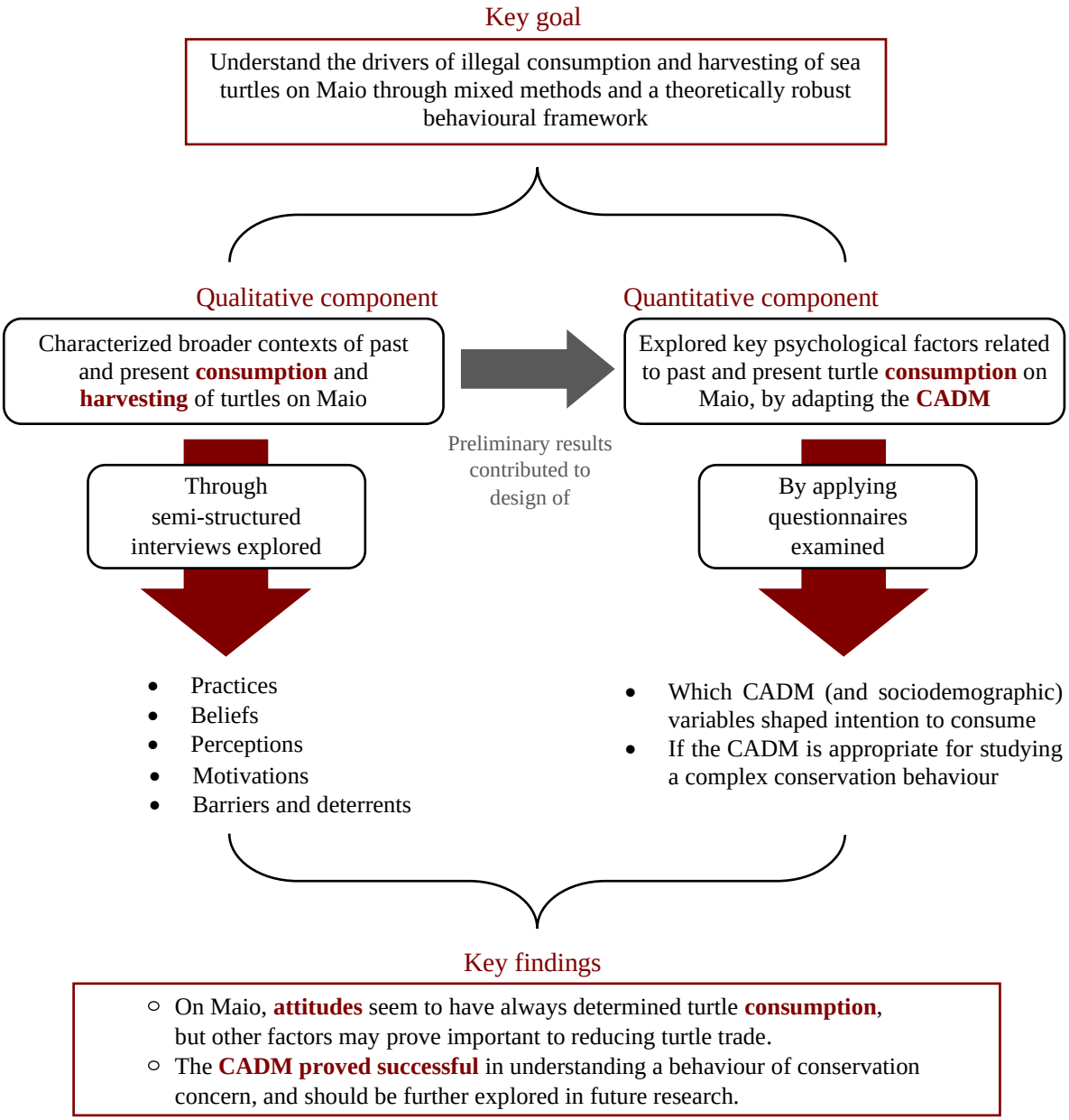

Figure GI.1 – Chart outlining the thesis' overarching goal, mixed methods components, brief results, and key findings.

Adapting a comprehensive behavioural model to investigate drivers of illegal sea turtle trade

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ABSTRACT

Successful conservation outcomes often depend on engaging with human communities and influencing behaviours that negatively impact biodiversity. Illegal wildlife trade illustrates this, as individual behaviours such as animal harvesting and consumption threaten global conservation goals. Inclusive psychology models that examine what motivates these behaviours have been underutilised in illegal wildlife trade contexts. This research aims to understand the drivers of illegal harvesting and consumption of sea turtles on Maio, Cabo Verde, by combining broad semi-structured interviews (N=20) with questionnaires (N=325) involving a comprehensive theoretical framework developed in environmental psychology. Local behavioural motivations seem to have changed over time, but some key beliefs remained intact. Structural equation modelling showed intention to consume turtles has always been influenced by attitudes, but other predictors may also be relevant to mitigating this behaviour. The same is likely true of harvesting, reportedly performed mostly by young men looking to sell turtle by-products. Beliefs underlying both behaviours are different, so outreach should carefully address each. These results further demonstrate how conceptual models developed in other scientific areas can be adapted to expand the interdisciplinary tools available to conservation practitioners. Embracing such approaches is crucial towards addressing the socially intricate and contextual behaviours of illegal wildlife trade.

Keywords: Cabo Verde, conservation psychology, mixed methods, sea turtle conservation, illegal wildlife trade

1. INTRODUCTION

The human dimensions of the multiple challenges facing wildlife conservation have been increasingly recognized (Newing et al. 2011; Bennett et al. 2016). The threat illegal wildlife trade (IWT) poses to many species exemplifies this reality, with relatively recent calls for the design and implementation of measures that focus on behavioural change to reduce demand and supply of illegal wildlife (Veríssimo 2013; Nilsson et al. 2020). Practitioners have begun to shift emphasis from restrictions, legislations and trade bans, as has been the norm, to designing interventions focused on consumer behaviours (Veríssimo and Wan 2018). Regulations and policies are crucial towards reducing IWT, but are most effective when complemented and informed by behaviour change methods and frameworks (Wallen and Daut 2018; Esmail et al. 2020). An expanded understanding and application of social science research is thus needed to adequately tackle wildlife harvest and consumption behaviours; this requires more, and improved, interdisciplinary tools and practices (St John et al. 2010).

The relatively new field of conservation psychology seeks to understand peoples' thoughts and behaviours regarding the natural environment and the conservation contexts with which they interact, in order to promote sustainable pro-conservation behaviours (Clayton and Brook 2005). Since its emergence in the early 2000s it has not yet penetrated mainstream conservation science and its impact is relatively small (Selinske et al. 2018). Gaining insight into key drivers of behaviours such as illegal wildlife hunting and consumption is essential not only to predict their development over time but to also promote strategies that reduce them by addressing their root motivations (Klöckner 2013; Thomas-Walters et al. 2020). Areas such as public health and recycling have successfully tested an array of behaviour predictors, ranging from social norms, economic incentives and moral obligations to spirituality, tradition, past experiences and many others (Clayton and Myers 2015; Bennett et al. 2017). Such holistic approaches have so far had limited application towards studying behaviours impacting conservation, the focus tending to be instead on peoples' general attitudes towards biodiversity, which are inadequate predictors of specific pro-conservation behaviours (Nilsson et al. 2020). This considerably limits the effectiveness of interventions and may even threaten existing values that positively influence conservation outcomes (St John et al. 2010).

There are many conceptual models that incorporate a richness of behavioural predictors and could potentially be of use in conservation practices. In an attempt to parsimoniously conjugate three commonly used models within environmental psychology (Theory of Planned Behaviour, Norm Activation Theory and the Value Belief Norm Theory), the Comprehensive Action Determination Model (CADM) was presented as a unifying framework seeking to minimize drawbacks found in each individual model while profiting from their advantages (Klöckner 2013). It consists of a relatively large number of psychological constructs that are more proximally or distally related to performing behaviours; however, if simplification is called for, the author himself proposes these can be scaled down to include only the closest determinants of behaviour (Figure 1.1). The CADM has so far been applied to research recycling, sustainable food consumption, energy conservation, purchasing fuel-efficient cars, reducing clothing consumption and similar environmental behaviours (Nayum and Klöckner 2014; Ofstad et al. 2017; Richter and Klöckner 2018; van den Broek et al. 2019; Joanes et al. 2020), but has not been adopted to understand behaviours directly linked to biodiversity.

Conservation would greatly benefit from broad and encompassing frameworks such as the CADM, which may be flexible enough to explain the complex behaviours that impact biodiversity (St John et al. 2010). Applying the model could help shape very different conservation interventions based on which distinct factors predict specific behaviours. However, psychological theories previously established to study environmental issues may simply not be appropriate for dealing with highly contextual and dissimilar conservation behaviours, such as within IWT (Selinske et al. 2018). The CADM's applicability to such circumstances must first be demonstrated before it can be recommended to conservation practitioners.

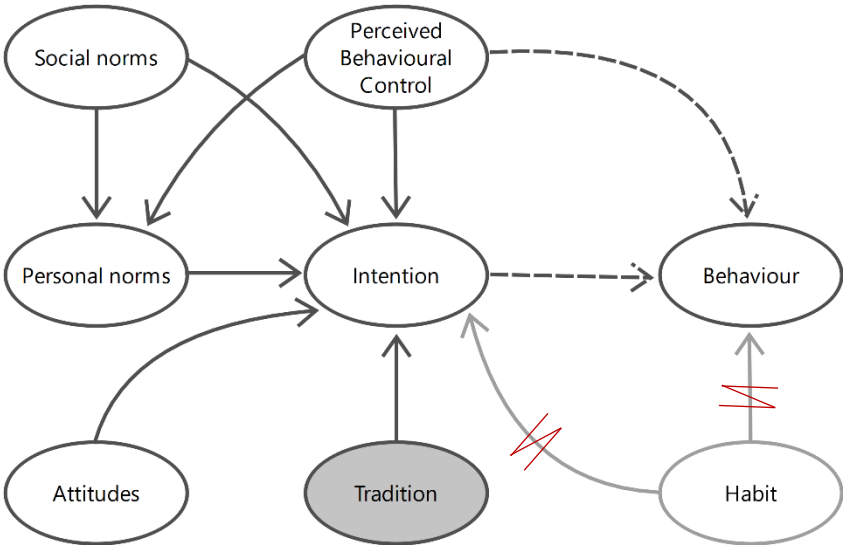


Figure 1.1 – Adapted CADM framework based on Klöckner (2013), showing the relationships between psychological variables that predict behaviour; habit (light grey) is included in the original model but here was substituted by tradition (shaded), which better addresses the nature of the research questions. Solid arrows show tested relationships while dashed arrows represent causal pathways that were not analysed in this study due to illicitness.

Sea turtles are an extensively researched taxon, with strong emphasis being given to biological and ecological aspects of their conservation (Campbell 2010). While those fields pose important questions, the paucity of interdisciplinary research contradicts the increased calls for social science frameworks that are needed within sea turtle conservation, as the most pressing issues that threaten it are often cultural and socio-economic (Campbell 2010; Rees et al. 2016; Godley et al. 2020). The direct usage of turtle products for consumption or commercial purposes is one such threat, that occurs extensively around the world and yet is specific to each individual regional context (e.g. Williams et al. 2019; Barrios-Garrido et al. 2019; Veríssimo et al. 2020).

Using enduring sea turtle trade on Maio island (Cabo Verde) as a case-study, this research aims to provide an in-depth understanding of the drivers of illegal consumption and harvesting of sea turtles in the study area by employing mixed methods and a theoretically robust behavioural framework. For this, (1) the broader contexts of past and present consumption and harvesting of turtles on the island were first characterized, by exploring inherent practices, motivations, barriers and cultural backgrounds through qualitative methods; then, (2) by adapting the CADM framework, key psychological factors potentially related to turtle consumption on Maio were explored, in both the past and present. Although developed within the niche of environmental psychology, CADM behavioural predictors are hypothesized to be significant in explaining intention to consume turtle meat, which would imply that it could constitute a comprehensive and flexible tool applicable to sea turtle conservation and other taxa subject to wildlife trade.

2. METHODS

This study employed a mixed methods approach to assess potential determinants of illicit behaviours related to sea turtle trade on Maio, primarily for turtle meat consumption. An initial phase of semi-structured interviews was performed to characterize past and present activities, motivations and social contexts related to consumption and harvesting of turtles on the island. Secondly, an island wide survey was conducted underpinned by the CADM framework to explore potential key psychological predictors of past and present intention to consume turtles on Maio. Participants were fully anonymized consenting adults, appropriate locally relevant social conventions were followed, and research was undertaken in

compliance with both University of Lisbon and European Union ethical guidelines (Iphofen 2013; Instituto de Ciências Sociais 2018).

2.1 Study area

The Cabo Verde archipelago, 500 km from the West African coast, hosts more than 95% of loggerhead sea turtle (*Caretta caretta*) nests in the whole eastern Atlantic, being the third largest nesting aggregation in the world (Marco et al. 2012). Conservation efforts at a national scale involve governmental authorities, recently implemented criminal legislations, environmental awareness campaigns and both local and international NGOs. Defiantly, harvesting and consumption of loggerheads have persisted and are responsible for the annual take of hundreds of nesting females (Marco et al. 2012; Direcção Nacional do Ambiente 2015). Yet, research regarding sea turtle trade in the country is scarce (but see e.g. Hancock et al. 2017).

The relatively small island of Maio (Figure 2.1) is among the most important islands for nesting, which recorded 7873 loggerhead nests in 2019 (FMB pers. comm. 2020). It comprises one single civil parish with a population of 6980 people, subdivided into 13 settlements ranging from 22 to almost 3000 inhabitants (Instituto Nacional de Estatística de Cabo Verde 2018). Although officially separate settlements, Santo António and Praia Gonçalo are often treated as a single community locally and were grouped together due to close proximity, very small populations and interconnectedness, therefore amounting to 12 total communities under study. Economically, lack of adequate infrastructure and sustained drought have resulted in a dependency on small scale agriculture, livestock and artisanal fishing, although remittance by migrants is also an important aid to local families (Santos 2005). The Maio Biodiversity Foundation (FMB), a local NGO, has conducted extensive work to protect sea turtles in the area since 2010 striving to promote community-based conservation throughout the island, including monitoring nesting beaches and providing economic opportunities for communities. Nonetheless, clandestine consumption of turtle meat, harvesting of female loggerheads on beaches, selling turtle meat locally or between islands, artisanal crafting using turtle shells, medicinal use of turtle organs and employing their penises as an aphrodisiac are activities that still occur (Martins et al. 2015).

2.2 Semi-structured interviews

To acquire a more in-depth understanding and contextual information regarding sea turtle trade on Maio, as well as to contribute to the later design of survey questionnaires, an initial series of interviews were conducted in October 2019. Semi-structured interviews were employed, consisting of discussions guided by a prepared interview script listing key questions and topics (Newing et al. 2011). Two types of interviews were defined, regarding either turtle harvesting or consumption, and were applied to men and women respectively, due to men's almost exclusive role in harvesting turtles on beaches or at sea while preparation and cooking were delegated to women (FMB pers. comm. 2019). Both types of interview followed the same structure, first asking detailed questions about consumption/harvesting over 15 years ago followed by more open-ended questions about the recent past and present. This allowed participants to answer candidly and in depth about past behaviours before choosing what to focus on when discussing recent events, that can be adequately probed by the interviewer.

Broadly, questions addressed turtle conservation, the actual processes of harvesting and consuming turtles, what body parts were used and why, motivations for these behaviours and their prevalence in different communities (interview scripts are available in Appendix A). As data collection progressed, novel lines of questioning were added throughout the interviewing process, as is frequent in grounded theory approaches (the most prominent framework for analysing qualitative data, which emphasizes constructing theory grounded in data; Bryman 2012; Corbin and Strauss 2015).

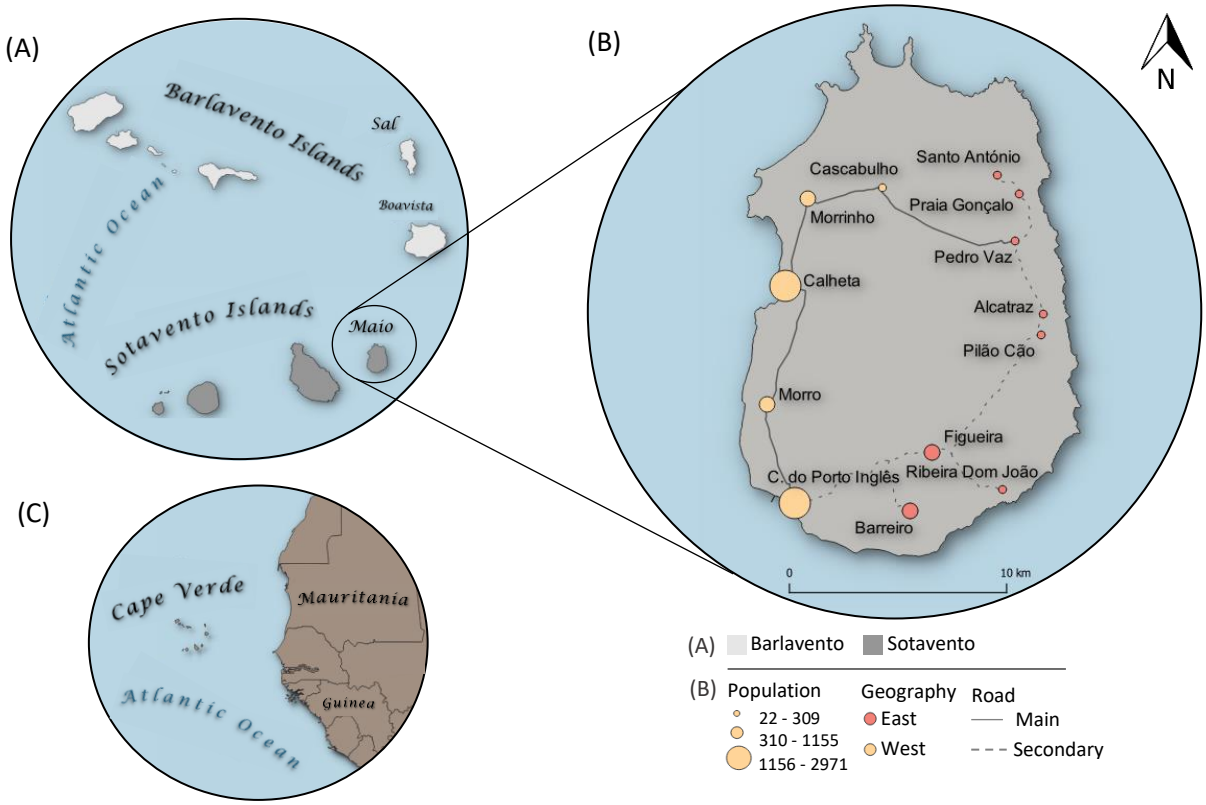


Figure 2.1 – Map of the study area. (A) Cabo Verde archipelago. (B) Maio island showing the population size of its communities, which for study purposes were grouped into 12 (Instituto Nacional de Estatística de Cabo Verde 2018), east/west division and road system. (C) The archipelago's location relative to the West African coast.

Because harvesting is a particularly sensitive subject and therefore privacy/confidentiality were of added importance, men were interviewed individually; women were interviewed in groups of three to six in order for outspoken and forthright participants to encourage apprehensive ones. Women within the same group were neighbours, friends or family. Participants were selected through targeted sampling whereby gatekeepers, such as community leaders or charismatic local women, referred researchers to consenting adults willing to talk about their direct experiences with the subject matter. A rough target sample size of 20 interviews (10 with individual men and another 10 with groups of women) in all 12 settlements was set. Once reached, data was reviewed and theoretical saturation was achieved – a point when further data collection provides little new information or dimensions towards understanding the research questions (Corbin and Strauss 2015).

Interviews were administered within participant's homes, in a mixture of Portuguese and *Maiense* creole by two Portuguese non-local researchers, one acting as facilitator while another took notes, aided in communication and was responsible for recording the proceedings (using two smartphone devices) to allow transcription. Interviews began informally, stating the purpose of the research, explaining confidentiality and recording consent. Two pilot interviews were performed in the same settlement with one man and three women and did not produce changes in interview scripts.

2.3 CADM questionnaires

Questionnaires consist of quickly administrable structured questions that allow for testing relationships between variables (Newing et al. 2011) and were employed to explore the relationships between the various CADM predictors (for definitions see Table 2.1). These questionnaires could not feasibly follow the framework through to behavioural outcomes (due to the illegality of turtle meat consumption),

Table 2.1 – Definitions for each CADM behavioural predictor (Ajzen 2006; Klöckner 2013; Mutalib et al. 2013).

Predictor	Definition
Attitudes	A general measure of the favourability a behavioural alternative has for an individual
Personal norms	Reflection of a person's own value system, their moral beliefs about right and wrong
Social norms	Perceived expectations of relevant other people towards a behaviour; in other words the perceived social pressure
Perceived Behavioural Control	Degree to which people perceive they have the opportunity/ability to perform a behaviour
Tradition	Extent that a behaviour is perceived as culturally inherited or established
Intention	The intention to perform a behaviour

instead focusing on intention – the immediate antecedent of behaviour (Ajzen 2006). Given this illicit nature and stigmatization of turtle consumption by most of the islands' population, as well as its dependency on turtles' annual nesting seasons, it would be inappropriate to integrate habit as a variable in this study. In order to maintain the general framework of the model while taking into consideration the specific context of the region, tradition is used in place of habit. Traditional or cultural values are known to contribute greatly towards conservation, favourably or otherwise (Mutalib et al. 2013; Singh et al. 2016).

Questionnaires were composed of three sections: (1) sociodemographic information, (2) items for consumption behaviour predictors in the present (3) and in the past, approximately 20 years ago (questionnaires are available in Appendix A). This timeframe was based on interview data that suggested turtle protection was then practically nonexistent. Sociodemographic variables were also drawn from preliminary interview results: gender, age, settlement size, geography (east/west), household size, level of education, monthly salary and time living in Maio (for detailed explanations see Table S1, Appendix B). Questions in the last two sections consisted of single or multiple items for each model variable, using five-point semantic differential or Likert-type scales. Except for timeframes, past and present items were worded in the exact same way to allow for comparison (for detail on items see the first two columns in Table 2.2).

Surveys were conducted in all settlements during November 2019, using two distinct sampling strategies to achieve a sample size of 330 (power analysis suggested that, for a 95% confidence level and 5% margin of error, ideal N = 363). The largest communities, Cidade do Porto Inglês and Calheta (2971 and 1156 inhabitants respectively) were subdivided into 30 smaller areas and within each one a participant was randomly selected; most buildings lacked numbering, so houses in each area were attributed numbers and random sampling was performed (Newing et al. 2011). Remaining settlements were small enough to sample each house, accounting for empty houses and non-response rates. Sampling units were defined as any person 18 years or older that resided on Maio. The questionnaire was reviewed by two local residents and a field pilot was administered (N = 13) in an area of the largest community, resulting in the rewording of two items; pilot study data from those items was not used in subsequent analyses. Surveys were carried out separately by two Portuguese non-local researchers in *Maiense* creole using tablets with digital forms on ODK Collect v.1.25.1 (Hartung et al. 2010).

Table 2.2 – Overview of latent variables and their items including means, reliability and standardized factor loadings (β).

Latent variable / questionnaire item	Bipolar scale[1]	Present			Past[2]		
		Mean (SE)	Factor loading[3]	Cronbach's α	Mean (SE)	Factor loading[3]	Cronbach's α
Attitudes				0.93			0.96
If I ate turtle next year, that would be	Pleasant / Unpleasant	4.21 (0.06)	0.87		1.61 (0.07)	0.96	
If I ate turtle next year, that would be	Good / Bad	4.25 (0.06)	0.80		1.59 (0.07)	0.92	
If I ate turtle next year, that would be	Valuable / Valueless	4.07 (0.07)	0.84		1.65 (0.07)	0.90	
Personal norms				0.66			0.67
If I eat turtle next year, I will feel sad	Disagree / Agree	3.65 (0.09)	0.71		1.51 (0.06)	0.76	
Next year it's my duty to not eat turtle	Disagree / Agree	3.92 (0.08)	0.73		1.62 (0.07)	0.64	
Social norms				0.50			0.49
My family thinks I should eat turtle next year	Agree / Disagree	4.36 (0.08)	0.58		1.70 (0.07)	0.54	
People like me will eat turtle next year	Agree / Disagree	3.34 (0.08)	0.57		1.31 (0.04)	0.84	
Tradition				-			-
Eating turtles is a tradition in Maio	Agree / Disagree	3.66 (0.09)	1.00		1.42 (0.06)	1.00	
Perceived Behavioural Control				-			-
If I *really* wanted to, I could eat turtle next year	Agree / Disagree	3.42 (0.08)	1.00		1.30 (0.04)	1.00	
Intention				0.79			0.94
Next year I intend on eating turtle	Agree / Disagree	4.59 (0.05)	0.90		1.79 (0.08)	0.97	
If I feel the need, next year I will eat turtle	Agree / Disagree	4.34 (0.06)	0.89		1.69 (0.07)	0.93	

[1]Scales ranged from 1 to 5 from left to right
[2]Wording of past questions changes the timeframe to "20 years ago"
[3]Factor loadings were standardized and all significant at $p < 0.05$

2.4 Qualitative data analysis

Interview analysis relied on common practices of grounded theory: theoretical sampling, coding, theoretical saturation and constant comparison of coded phenomena (Bryman 2012). Data collection and early analysis occurred in parallel, as basic thematic coding and memo writing began following the first interviews, by breaking the data into segments of meaning, labelling them and taking ongoing notes about them. Codes were developed from the data, being frequently revised and re-explored until common/revealing codes produced various concepts and overarching themes (Bryman 2012; Linneberg and Korsgaard 2019). Categories were saturated – meaning their properties and dimensions were well developed and contained sufficient variation – allowing exploration of relationships between them to generate hypotheses (the code system is available in Appendix C). Notes taken later on during unstructured conversations with survey participants were included in this analysis. Concept maps were generated throughout coding to aid analysis (such as Figure 2.2); coding was performed using MAXQDA 2020 (VERBI Software 2019).

2.5 Analysis of CADM questionnaires

Preliminary descriptive analysis was first performed to reorder item responses (1 being the most favourable towards turtle consumption and 5 the least), eliminate missing data (removing five questionnaires) and explore sociodemographic data. Cronbach's alpha tests were conducted to estimate the validity and reliability of all questionnaire items relating to the CADM, but as some values did not reach the customary thresholds (>0.85) items were further analysed during confirmatory factor analysis, which has shown better results in testing validity/reliability of instruments (Said et al. 2011). Mardia's multivariate normality tests were run for CADM items from both past and present datasets; as multivariate normality was not verified (z-scores >5), the generally employed Maximum Likelihood estimation method was substituted by Maximum Likelihood estimation with robust standard errors (MLR) for all subsequent analyses (Gana and Broc 2019; Rosseel 2020).

Structural equation modeling (SEM) was used to assess the network of relationships between CADM variables. SEM is an inclusive and flexible approach of testing hypothesized relations among both observed (measured) and unobserved (latent) variables (Suhr 2006). Measured variables are essentially items such as the ones in the questionnaire, while latent variables (LVs) are a construct defined by multiple items (for LVs and their items see Table 2.2; Gana and Broc 2019; Thakkar 2020).

The common SEM approach was followed, of first specifying the model (in this case the CADM), then determining model identification and estimating its parameters, and finally assessing model fit (Suhr 2006). The underlying framework of indicators that measure LVs (measurement model) is estimated through Confirmatory Factor Analysis (CFA), followed by determining the interrelations between variables (structural model). Sociodemographic variables were included in the structural model to control for any potential effects on intention. As the same model was specified for past and present, establishing measurement invariance is a prerequisite for testing mean differences across time (Putnick and Bornstein 2016). Finally, latent growth modeling, a longitudinal analysis within SEM, was employed to answer three questions: do predictors of intention and intention itself change significantly from past to present, are there differences in their initial levels and rates of change between participants, and do any sociodemographic variables influence these changes (Preacher et al. 2008; Serva et al. 2011). Statistical analyses were conducted using RStudio 1.1.546 and the lavaan 0.6-6 package (Rosseel 2012; R Core Team 2020).

Following current recommendations (Putnick and Bornstein 2016), for each model a variety of fit indexes are reported (see Table S2, Appendix B). However, due to the effect of sample size and non-normal distributions on chi-square and $\chi 2$/df values, incremental and absolute fit indexes are more relied upon (Hu and Bentler 1999; Putnick and Bornstein 2016; Gana and Broc 2019).

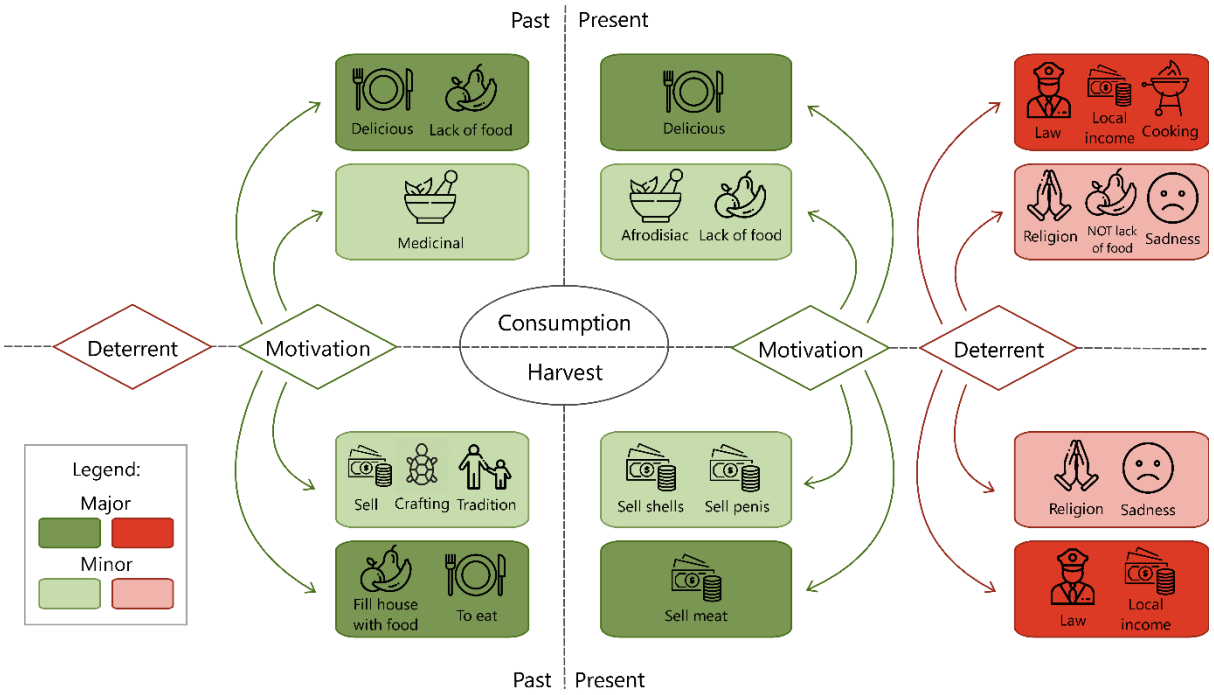


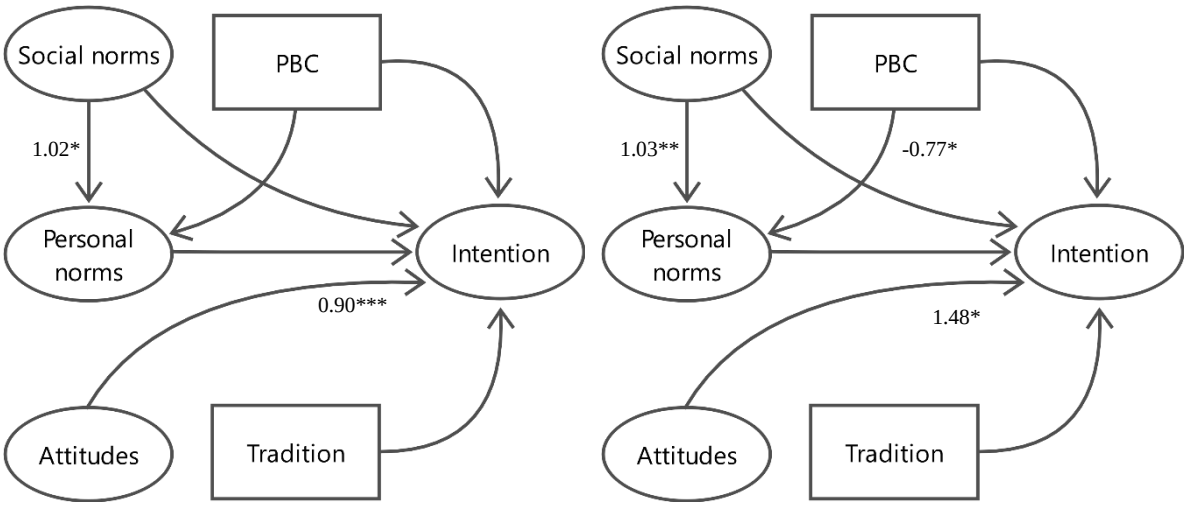
Figure 2.2 – Conceptual map of motivations and deterrents for past and present consumption and harvesting, constructed using qualitative data collected in interviews and field notes. Motivations and deterrents are displayed as either major or minor according to participants' perceptions and descriptions of these factors rather than the frequency of their coding.

3. RESULTS

3.1 Practices, motivations and barriers of consumption/harvesting

The main categories that emerged from the data obtained through semi-structured interviews fit into three overarching themes targeted in the interviews, all divided into past and present: narratives about consumption, about harvest, and motivations/deterrents determining both behaviours (Figure 2.2). Past consumption (i.e. approximately 15 years ago) was described in detail, with explanations of how different turtle parts were cooked or sometimes used in crafting. Participants unanimously acknowledged that the entire population – save exceptional individuals who found the strong smell of cooked meat nauseating – ate turtles before they were protected. No consensus existed as to when protection began, but participants agreed it increased considerably after the FMB interceded and ensuing the criminalization of turtle consumption in 2017. Consumption was reported to have decreased greatly thanks to new legislation and awareness. People who persist were said to have adopted strategies to avoid discovery; due to its intense smell, cooking meat undetected is challenging. Some participants disclosed that given the right opportunity, they would indulge in consumption.

Regarding past harvesting, participants mentioned that men would leave their communities in small groups to patrol beaches until they found turtles. Their plastrons would be removed and meat/organs were cut away, remaining alive for almost the entire process – various participants reflected on how sad this method currently made them feel. These groups were reported to ordinarily catch more than one turtle per night, frequently up to five or even ten. Some participants asserted harvesting was a daily activity, while others said it occurred once or twice a week. Catching turtles at sea was stated to be common but performed opportunistically by fishing boats, often capturing them during mating. Concerning present harvesting, some participants either denied its existence or affirmed it has become very rare in recent years. Others explained it still occurs, sometimes recounting new strategies used by harvesters to evade detection by beach guards.



Past SEM Present SEM

Figure 3.1 – Results of past and present structural equation models, showing unstandardized structural coefficients of statistically significant effects ($^{*}p \leq 0.05$; $^{**}p \leq 0.01$; $^{***}p \leq 0.001$). Ellipses and rectangles represent multiple and single item LVs respectively; PBC – perceived behavioural control.

Past consumption and harvesting were described to be associated with several motivating factors but not a single deterrent, being recounted as just a part of everyday life (Figure 2.2). Participants conveyed consumption was mostly prompted by turtles' delicious meat and lack of food/poverty, with infrequent mentions of medicinal purposes. Harvesting was said to be driven by consumption itself while also to "fill the house" with other foods, by trading turtle meat for rice, potatoes, etc.. Current behaviours showed both incentives and deterrents (Figure 2.2). Turtle meat's flavour was mentioned as the near-exclusive motivation for consumption. Most participants observed that consumption can no longer be attributed to poverty, as other food is more readily available and turtle nesting is seasonal. Harvesting is now reportedly largely connected to selling turtle meat, but occasionally shells and penises (an aphrodisiac); the market for meat was allegedly created by the illegalization of consumption/harvesting, as before turtles could be freely caught. Meat is assertedly sold to locals or on the nearby island of Santiago for higher prices (for disclosed prices of turtle products see Table S3 Appendix B). Participants blamed harvesting on young men unable to find jobs or men addicted to drugs/alcohol/cigarettes. Recorded deterrents for consumption and harvesting coincided: fear of law enforcement and the dependence of local incomes on turtle conservation are major obstacles, the sadness of harvesting and religious restrictions (on Adventists) being minor ones. Difficulty to covertly cook turtle meat was a barrier exclusive to consumption.

Some issues were only discussed after direct questioning, such as usage of turtle penises, the ecological and inherent value of turtles, and how consumption/harvesting varied between communities. One of these is important to highlight – perceptions that turtles are smaller and less tasty than in the past due to coming from "nurseries", "laboratories", "captivity", "freshwaters", "mixed with foreign species" or "injected with medicine".

3.2 Psychological factors driving turtle consumption

After removing missing data from CADM questionnaires, data from N = 325 survey participants was able to be used (no one refused to participate). Of these, 270 were old enough to be able to answer questions concerning past consumption (i.e. behaviours 20 years ago). On average, 9.2% of residents were sampled in each of the 12 settlements (4.7% of the islands inhabitants), having a median age of 45-54 and being two-thirds women (see Table S4 Appendix B).

Table 3.1 – Estimates for attitudes and intention latent growth models (LGM) showing intercept and slope estimates, their variance, and unstandardized regression coefficients (B) of relevant variables ($^{*}p \leq 0.05$; $^{**}p \leq 0.01$; $^{***}p \leq 0.001$; n.s – not significant).

LGM	Latent construct	Estimate	Variance	Household size (B)	Geography (B)
Attitudes	Intercept	1.840^{***}	0.259^{***}	-0.216^{*}	(n.s)
	Slope	2.563^{***}	0.558^{***}	0.311^{*}	-0.456^{*}
Intention	Intercept	2.102^{***}	0.284^{***}	-0.284^{**}	(n.s)
	Slope	2.763^{***}	0.502^{***}	0.289^{*}	-0410^{*}

Both the measurement and structural models for past and present data showed good or acceptable fit (see Table S5 Appendix B) and all standardized factor loadings were satisfactory (Table 2.2). Measurement invariance established strong invariance between years (see Table S5 Appendix B). For past and present data, attitudes was the only LV to significantly predict intention (B = 0.90, p = 0.001 and B = 1.48, p = 0.04 respectively; Figure 3.1). Although unrelated to intention, personal norms were affected similarly by social norms in the past and present (B = 1.02, p = 0.03 and B = 1.03, p = 0.01 respectively; Figure 3.1) but were determined by perceived behavioural control (PBC) only in the present (B = -0.77, p = 0.01; Figure 3.1). Sociodemographic variables showed no significant relationships with intention in either model, suggesting these effects are widespread across groups.

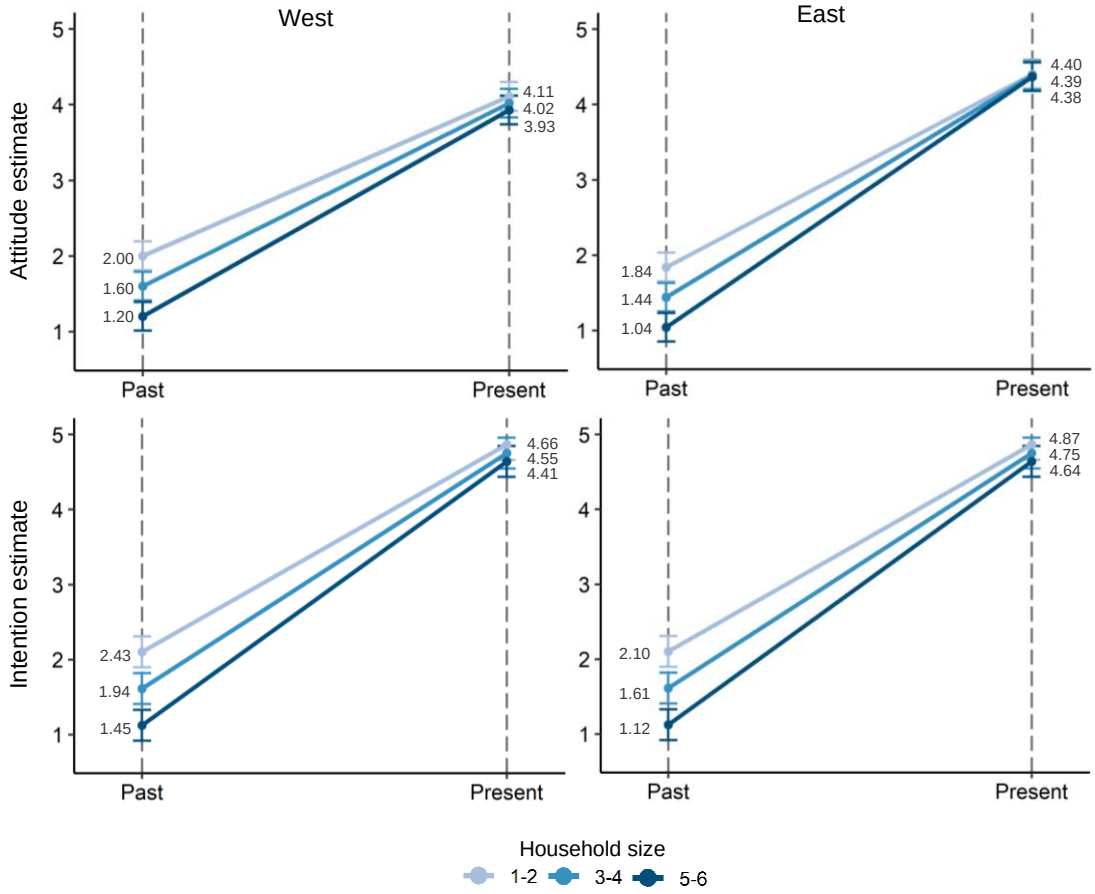


Figure 3.2 – Linear change in mean attitudes (top) and intention (bottom), from past to present, according to household size groups, in west (left) and east (right) settlements. Lower estimates reflect favourability towards turtle consumption.

The latent growth model for attitudes showed excellent fit, and after correcting a Heywood case due to sampling fluctuation (Dillon et al. 1987) so did the intention model (Table S5 Appendix B); model estimates are shown in Table 3.1. Slope and intercept estimates were significant in both models, indicating change in mean attitudes and intention over time. Their respective variances were also significant, suggesting that interindividual differences exist in the initial mean levels and change over time of both attitudes and intention, that could be explained by sociodemographic variables. Of the sociodemographic variables tested, both models' intercepts were related to household size, while slopes were affected by household size and geography (Table 3.1).

Overall, latent growth models indicate three things: attitudes and intention changed significantly over time; larger households are related to significantly lower scores in past attitudes and intention, but increased more over time; past attitudes and intention did not differ significantly according to geography, but did increase considerably more in eastern settlements than western ones (Figure 3.2). Measurement invariance across these groups can be found in Table S5 Appendix B.

4. DISCUSSION

Despite calls for increased insights into human facets of both IWT in general and sea turtle conservation specifically (Milner-Gulland et al. 2018; Godley et al. 2020), there continues to be a lack of social science applications within these fields (Bennet et al. 2017; Veríssimo and Wan 2018). This research endeavours to understand the factors determining consumption and harvesting of sea turtles on Maio island, through qualitative semi-structured interviews and a behavioural model developed within environmental psychology. Findings suggest attitudes have been the largest driving cause of turtle consumption, while PBC may play a meaningful role in preventing the behaviour from being executed; the same seems true of harvesting but its sensitive nature makes it difficult to confirm. Results indicate measures such as social marketing and outreach programmes should be carefully tailored to focus on reshaping these psychological constructs, while taking care to not dismantle values that may positively influence conservation. Importantly, this study showcases a previously unexplored comprehensive behavioural framework that can be incorporated into a wider variety of conservation psychology issues.

4.1 Attitudes: the cornerstone of illegal behaviours

Findings suggest both sea turtle consumption and harvesting in the study area have always been impacted by attitudes, from the present dating back to before sea turtle conservation was established on Maio.

Regarding consumption, it seems clear that attitudes play a vital role in maintaining this behaviour. It was the only CADM variable shown to affect intention across time, while major consumption motivations drawn from qualitative data could be interpreted as attitudinal elements. Participants often described delight from eating turtle meat and peace of mind offered by acquiring substantial quantities of food, which are likely affective components of attitudes that involve feelings and emotions (McLeod 2018). Despite their major motivating role, changing these attitudes alone may not suffice to decrease consumption – as strong and stable constructs, they may remain accessible to individual's motivations even after seemingly being neutralized (Bohner and Dickel 2011). Interestingly, the encountered belief that turtles are now less tasty because they are "raised in nurseries" or "injected with medicine" could hold some value to conservationists. Rumours concerning protected species are common in certain fields of wildlife conservation (Skogen et al. 2008; Delibes-Mateos 2016), but regardless of their veracity should purposefully not be deconstructed as they are potentially beneficial cognitive components of attitudes towards preventing consumption (McLeod 2018). Additionally, awareness of local livelihoods' dependency on turtle conservation through job creation and tourism may also strengthen their protection, as many participants acknowledged this as a strong deterrent.

Semi-structured interviews and latent growth models suggest eastern populations were historically more intense consumers but presently show similar characteristics to western ones, possibly thanks to recent outreach initiatives targeted at hostile communities. Furthermore, individuals from larger households showed greater increases in attitudes/intention perhaps due to illegal behaviours being harder to furtively accomplish compared to people who live alone.

Although addressed solely through interviews, harvesting appears to be similarly motivated by attitudes. In the past these were likewise concerned with food and consumption, but presently are related to fast and easy ways of earning money through trade, comparable to other Cabo Verde islands (Hancock et al. 2016). For example, locally turtle meat is cheaper than many other meats on the island, similar to prices found on Boa Vista island (Martins et al. 2012); when exported to Santiago, a single turtle can generate several months' worth of salaries (for values of turtle products see Table S3 Appendix B). Harvesting and consumption share the same deterrents, but as their motivating attitudes differ substantially, developing measures to mitigate each behaviour should be carefully considered.

4.2 Perceived behavioural control and potential deterrents

Results point to law enforcement as a major deterrent of consumption/harvesting behaviours in the area, due to fear of being caught. This points to a lack of perceived self-efficacy: an individual's beliefs about their ability to exercise control over a behaviour, and an integral component of PBC (Bandura 1991; Barlett 2019). As it did not predict intention in the CADM, PBC may potentially play a decisive role in consumption/harvesting unmediated by intention (Figure 1.1), but identifying such a direct effect through questionnaires would be challenging as it generally requires participants to openly admit to practising illegal acts. This relationship seems to be supported by rises in harvesting in 2020 due to reductions in beach monitoring stemming from COVID19 measures (Lusa 2020), which seemingly raised self-efficacy perceptions enough to affect behavioural outcomes. Research on other Cabo Verde islands also shows law enforcement can be undermined by a perceived lack of beach protection (Hancock et al. 2016). Future efforts should address partial gaps in monitoring, such as prematurely ending patrols before turtle nesting has concluded.

In this study, tradition, personal and social norms were not found to meaningfully shape intentions (Figure 2.2) but minor deterrents taken from interviews could be related to some of these. Participants who revealed that exposure to live turtles aroused sadness over their killing, along with passages from the Bible prohibiting turtle consumption, may constitute examples of personal norms that evoke morality and guilt (Doran and Larsen 2016). Prospective conservation programmes could attempt to form new personal norms through interaction with turtles (experiencing a behavioural object could aid in behaviour change; Heimlich and Ardoin 2008) or by incorporating religious passages in their messaging (as a large portion of the population is devout Catholic; Bureau of Democracy, Human Rights and Labour 2007). Likewise, outreach initiatives that incorporated context-specific stakeholders were conducted in certain communities, achieving reasonable success. This supports recommendations about including carefully considered social norms when tailoring conservation management (Mbaru and Barnes 2017). Additionally, no measured sociodemographic variable predicted intention, corroborating previous research concerning turtle consumption that demonstrated the possibly weak predictive power of demographic variables (Veríssimo et al. 2020).

4.3 Towards applications within conservation psychology

This research successfully combines a broad qualitative approach with a behavioural model previously unexplored within conservation. Despite its inception in environmental psychology (Klöckner 2013), the CADM showed adequate fit to data collected about turtle consumption on Maio, suggesting it may translate effectively to other instances of sea turtle trade and similar IWT issues. Much like research applications in its original field, the model's relatively holistic structure facilitated altering certain factors – particularly habit – to fit specific social contexts (Ofstad et al. 2017; Joanes et al. 2020). Crucially, this framework could help expand the overall conservation social science toolbox and address

the scarcity of psychological theories found in current conservation literature (Bennet et al. 2017; Selinske et al. 2018). Furthermore, the CADM may provide an opportunity to measure and evaluate the impacts that management actions have on a range of behavioural factors across time. Although this allows practitioners to recognize what works and what does not when confronting IWT, systematic impact evaluation has been limited (Nuno et al. 2018; Thomas et al. 2019; Veríssimo and Wan 2018).

Opting to complement behavioural modelling with semi-structured interviews was insightful, by aiding in contextualizing model results, interpreting how future outreach programmes should proceed and which audiences they should tackle in the study area. Past research shows that, despite criticisms from natural scientists, qualitative studies provide deeper understandings of how to improve conservation practices (Rust et al. 2017) and of the complex factors involved in IWT (‘t Sas-Rolfes et al. 2019). Therefore, it seems conservation research adopting social psychology models would likely benefit from including some degree of qualitative methodology.

5. CONCLUSION

Conservation management is often insufficiently based on coherent and rigorous behaviour change strategies (‘t Sas-Rolfes et al. 2019). Here, a conceptual model developed in environmental psychology was applied to an IWT context, which complemented by qualitative methods provided insights into drivers of sea turtle harvesting and consumption on Maio, Cabo Verde. The results presented support how comprehensive behavioural theories can effectively guide practitioners in promoting sustainable pro-conservation behaviours, by understanding the psychological factors that motivate them (Selinske et al. 2018). Future efforts should use this knowledge to design appropriate outreach programmes, tailored to specific factors and target groups, as to mitigate threats to important turtle populations. More broadly, this research further highlights how conservation can benefit from previously existing frameworks validated in similar scientific fields. It remains clear that within sea turtle trade – similar to conservation as a whole – the value of mainstreaming social science knowledge is undeniable and should not be ignored.

6. ACKNOWLEDGEMENTS

This research was supported by the Maio Biodiversity Foundation (FMB). Funding came from MAVA Fondation pour la Nature and NOAA USFWS. Special acknowledgements to the staff for their input, especially Patino-Martinez J. and Amador R. for aiding in study design, and Carneiro I. and Mota I. for fieldwork assistance. Further thanks to local leaders for facilitating data collection, and to all interview and survey participants.

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CONCLUDING REMARKS

In closing, brief comments should be made about critical reflections on the present research, particularly some of its specific limitations. Overall, it succeeds in both its objectives: broadly characterizing past and present contexts of consumption and harvesting on Maio; and exploring psychological factors related to turtle consumption on Maio. Past research has engaged with similar goals within illegal sea turtle trade (Hancock et al. 2016; Nuno et al. 2018; Veríssimo et al. 2020), but has not dealt with such comprehensive approaches to psychological drivers of its illicit behaviours. Furthermore, this study represents the first instance of the CADM's application outside environmental psychology, and one of the few examples of adapting frameworks developed in that area to conservation (St John et al. 2010; Selinske et al. 2018).

Upon concluding this research, some limitations related to its quantitative component were identified, which although minor deserve addressing. Firstly, the past model showed worse fit compared to the present model (Table S5 Appendix B), possibly caused by memory biases resulting from measuring psychological variables from 20 years ago. However, as both model specifications were identical and applied to the same participants – and the present model displayed good fit – this loss of fit can be reasonably disregarded. Secondly, although the factor loadings of social norm items are enough to validate them as indicators, they are somewhat lower when compared to other indicators (Table 2.2). This was due to both these items referring to different types of social norms (injunctive and descriptive), so that future studies could perhaps treat them as separate constructs. Thirdly, the number of items/LV was kept low, to avoid becoming too long or repetitive for participants (as all items were repeated for past and present consumption). Any future questionnaires can expand the number of items/LV, as a baseline of information has now been established.

The importance of the field work being mostly conducted by a foreign student quickly became apparent in an unexpected way. This relates to an epistemological phenomenon known as a researcher's "insider" or "outsider" identity, where researchers' membership roles in a study area may affect data collection and analysis (Kerstetter 2012). Initially, we expected data collection to be somewhat negatively impacted by poor fluency in *Maiense* creole. However, the advantage of being perceived as an "outsider" seems to have far outweighed these concerns: by participants' own admissions, honest discussions between locals and conservationists about intention to consume/harvest turtles would likely be less productive. Participants did not easily admit to contemplating these behaviours, for fear of legal and social consequences. Being an "outsider", with a limited stay in the study area, lessened participant's apprehensions and therefore benefited results. This should encourage NGOs to incorporate students in similar projects, while further research concerning the repercussions of "insider" and "outsider" identities in conservation would be valuable.

In all, this study contributes towards strengthening the application and impacts of conservation psychology in IWT research, particularly by addressing the lack of holistic theory-based approaches taken so far (Milner-Gulland et al. 2018; Wallen and Daut 2018). Reducing consumer demand for illegal wildlife products requires policymakers to acknowledge the usefulness of behaviour change methods (Esmail et al. 2020). To a broader extent, it supports collaborations between conservation practitioners and trained members of the social science community (Bennet et al. 2017; Wallen and Daut 2018). This diversification of approaches will ultimately lead to deeper understandings of conservation challenges and how they can most effectively be solved.

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APPENDIX A
Interview and survey scripts

Consumption interview – Groups of women

RESEARCH STATEMENT

To uncover shared perceptions, attitudes, behaviours and habits related to consumption of turtles and their by-products, now and in the recent past (before the implementation of prohibitive legislation); to triangulate with survey findings about behavioural predictors

- SECTIONS

- Section I – Structured questions about turtle consumption ~15 years ago
- Section II – Open discussion about turtle consumption ~5 years ago
- Section III – Questions about current turtle consumption

PARTICIPANT TRAITS

- Be female
- Be over 18 years old
- Have lived at least 15 years in their current community
- Speak Portuguese at a base level
- Be on friendly terms with participants within the same focus group
- Consent to participate and be recorded

- SECTIONS

SETTING OF INTERVIEW

- Participants' houses
- Local meeting area (provided it is private and uninterrupted)

Introduction

[Read slowly and clearly]

Thank you again for accepting to participate in this interview. As you know, my name is Morgan and I am student at Lisbon University in Portugal. I am on Maio studying the past and present of poaching turtles here on the island. I am doing many interviews with different people from different communities. The interviews will be used for my master's dissertation.

I've asked *[gatekeeper name]* to point me to people who I should interview. They told me you could help answer my questions.

Here there are no wrong answers, only your opinions and stories. You can speak freely about whatever you want, I am interested in all kinds of answers, positive or negative. Anything you want to say will help my study.

[Point to recording device] As you can see I am recording the interviews. This recording is for **me** to listen to again at home. Sometimes I cannot remember what was said, or my assistant can't write everything down, and because I don't want to lose any of your answers I need to record the conversation. I also don't speak creole fluently, so at home I can listen again to better understand what you've said. Only I am going to listen to the recording, nobody else. Your answers will remain completely anonymous.

I'll repeat that just to make it clear: don't be worried about your answers, you can talk about whatever you want. I am here to learn from you.

I'll call you by name now, but in my research your name won't be included. When you answer, if you can, try to speak clearly so I can understand.

Have you got any question before we begin?

So, to start could you tell me your names, your ages, and how long you've lived in this community?

[If nobody starts, begin from left to right]

[Draw in notes a layout of the interview space, researchers and participants]

Section I – Turtle consumption ~15 years ago

[Read slowly and clearly. Try not to exceed 5 minutes for each question, but don't cut the flow of the interview. Below each question are follow up questions that may be needed to further the conversation]

(1) – Now I would like you to think about life on Maio around 15 years ago. How was this community 15 years ago?

(2) – Did turtle protection exist back then?

(3) – Tell me how turtle consumption was 15 years ago.

[Depending on the answer, it may not be necessary to ask some of the following questions.]

(4) – At that time, what products did people use that came from turtles? *(Clarification: After catching a turtle what parts did you use?)*

- Did you eat turtle meat? Their eggs? Did you use their shell?
- Which product was most used?

(5) – In this community, how many people harvested turtles?

- Everyone? Most people? Only a few?
- What kinds of people ate turtle? Men and women? Children? Mostly fishermen?

(6) – Why did people consume turtles?

- Was it normal to consume turtle penis? Why?
- Did tourists or foreigners eat turtle?

(7) – How many times a year did people eat turtle?

- How many turtles were consumed each month in this community?

(8) – Where did people get the turtle meat from? *(Would they buy it, harvest it themselves…)*

- Did they buy it from people here in the community? Or from other communities? Would they go to the beach themselves to catch turtles?

(9) – Were there communities where people consumed more turtles? Or less?

- Which ones?
- Why was that?

Section II – Turtle consumption ~5 years ago

[This section asks broader questions to see what participants choose to mention, seen as many thinks have previously been addressed.]

(1) – So far we have spoken about consumption around 15 years ago. Now I want you to remember how things were 5 years ago. Are there differences between 15 and 5 years ago?

- What are those differences?
- Why do those differences exist?
- Were turtles protected 5 years ago?
- 5 years ago, were more people consuming turtles, or less?

Section III – Harvesting turtles in the present

[Let participants talk freely. Follow up questions may or may not be needed depending on how openly participants are talking]

(1) – We are almost finished. I want to talk about how turtle consumption is now. Is it still the same as 15 years ago?

(2) – What has changed between now and 15 years ago?

- Are turtles currently protected?
- Are there more, or less, people consuming turtle nowadays in comparison with 15 years ago?
- Which communities consume the most turtles now? What about the least?
- Where do people get turtle meat from now? Do they buy it, harvest it themselves…?
- What turtle products are used now?

(3) – Before we finish, is there anything else you would like to say?

- Are there any interesting stories regarding turtles that you can remember?

That is the end of the interview. Thank you again for participating, it is a great help towards my studies. Your answers will stay anonymous and will be used for my university work in Portugal. When I finish, I will send a summary to the community leader, for you to read if you want to.

END OF INTERVIEW

ATTENTION!

Many useful comments are said after the interview has officially ended and the recording device has been shut off. Any relevant comment should be made note of as quickly as possible after leaving the location.

Harvesting interview – individual men

RESEARCH STATEMENT

To uncover individual perceptions, attitudes, behaviours and habits of former harvesters related to harvesting turtles and their by-products, now and in the recent past (before the implementation of prohibitive legislation); to triangulate with survey findings about behavioural predictors.

SECTIONS

- Section I – Structured questions about turtle harvesting ~15 years ago
- Section II – Open discussion about turtle harvesting ~5 years ago
- Section III – Questions about current turtle harvesting

PARTICIPANT TRAITS

- Be male
- Be over 18 years old
- Previous turtle harvester (at least 15 years ago)
- Speak Portuguese at a base level
- Consent to participate and be recorded

SETTING OF INTERVIEW

- Participants' houses
- Local meeting area (provided it is private and uninterrupted)

Introduction

[Read slowly and clearly]

Thank you again for accepting to participate in this interview. As you know, my name is Morgan and I am student at Lisbon University in Portugal. I am on Maio studying the past and present of poaching turtles here on the island. I am doing many interviews with different people from different communities. The interviews will be used for my master's dissertation.

I've asked *[gatekeeper name]* to point me to people who I should interview. They told me you could help answer my questions.

Here there are no wrong answers, only your opinions and stories. You can speak freely about whatever you want, I am interested in all kinds of answers, positive or negative. Anything you want to say will help my study.

[Point to recording device] As you can see I am recording the interviews. This recording is for **me** to listen to again at home. Sometimes I cannot remember what was said, or my assistant can't write everything down, and because I don't want to lose any of your answers I need to record the conversation. I also don't speak creole fluently, so at home I can listen again to better understand what you've said. Only I am going to listen to the recording, nobody else. Your answers will remain completely anonymous.

I'll repeat that just to make it clear: don't be worried about your answers, you can talk about whatever you want. I am here to learn from you.

I'll call you by name now, but in my research your name won't be included. When you answer, if you can, try to speak clearly so I can understand.

Have you got any question before we begin?

So, to start could you tell me your name, your age, and how long you've lived in this community?

[Draw in notes a layout of the interview space, researchers and participant]

Section I – Turtle harvesting ~15 years ago

[Read slowly and clearly. Try not to exceed 5 minutes for each question, but don't cut the flow of the interview. Below each question are follow up questions that may be needed to further the conversation]

(1) – Now I would like you to think about life on Maio around 15 years ago. How was this community 15 years ago?

(2) – Did turtle protection exist back then?

(3) – Tell me how turtle harvesting was 15 years ago.

[Depending on the answer, it may not be necessary to ask some of the following questions.]

(4) – At that time, what products did people use that came from turtles? *(Clarification: After catching a turtle what parts did you use?)*

- Did you harvest turtles for their meat? Did you eat their eggs? Was turtle penis consumed? Did you use their shell?
- Which product was most used?

(5) – In this community, how many people harvested turtles?

- Everyone? Most people? Only a few?
- What kinds of people did that? Fishermen? People with less money? Young men?

(6) – Why did people harvest turtles?

- To sell for money?
- To eat at home?
- Because it was easy and costless?
- Because it was tasty?
- Because it was common?

(7) – How many turtles would someone normally harvest in total?

- How many turtles were caught each month during nesting season?

(8) – Did harvesters sell turtle meat? Where

- In the community?
- In Vila (Cidade do Porto Inglês)?
- Did they sell eggs?

(9) – Were there communities where people harvested more turtles? Or less?

- Which ones?
- Why was that?

Section II – Turtle harvesting ~5 years ago

[This section asks broader questions to see what participants choose to mention, seen as many thinks have previously been addressed.]

(1) – So far we have spoken about harvesting around 15 years ago. Now I want you to remember how things were 5 years ago. Are there differences between 15 and 5 years ago?

- What are those differences?
- Why do those differences exist?
- Were turtles protected 5 years ago?
- 5 years ago, were more people harvesting turtles, or less?

Section III – Harvesting turtles in the present

[Let participants talk freely. Follow up questions may or may not be needed depending on how openly participants are talking]

(1) – We are almost finished. I want to talk about how turtle harvesting is now. Is it still the same as 15 years ago?

(2) – What has changed between now and 15 years ago?

- Are turtles currently protected?
- Are there more, or less, people harvesting nowadays in comparison with 15 years ago?
- Which communities harvest the most turtles now? What about the least?
- What do harvesters do with turtles now? Sell them, eat them…?
- What turtle products are used now?

(3) – Before we finish, is there anything else you would like to say?

- Are there any interesting stories regarding turtles that you can remember?

That is the end of the interview. Thank you again for participating, it is a great help towards my studies. Your answers will stay anonymous and will be used for my university work in Portugal. When I finish, I will send a summary to the community leader, for you to read if you want to.

END OF INTERVIEW

ATTENTION!

Many useful comments are said after the interview has officially ended and the recording device has been shut off. Any relevant comment should be made note of as quickly as possible after leaving the location.

Survey Questionnaire – Consumption

Note: Even if not specified in the document, every question, from all three different sections, may be answered with "I do not know" or "I do not want to answer".

Section A: Sociodemographic information

1) Gender: Male / Female

2) Age (in years): 18 – 24 ☐ 25 – 34 ☐ 35 – 44 ☐ 45 – 54 ☐ >55 ☐

3) Where do you live? Morro / Calheta / Morrinho / Cascabulho / Praia Gonçalo / Santo António / Pedro Vaz / Alcatraz / Pilão Cão / Ribeira Dom João / Figueira / Barreiro / Não quer responder

4) How many people live in your house? 1-2-3-4-5-6-7-8-9-10-11-12-13-14-15

5) Until when were you in school? Or, if you are still in school, what year do you attend?

I can't read or write ☐ 1st – 4th year ☐ 5th to 9th year ☐ 10th to 12th year ☐ University ☐
Don't know / Don't want to answer ☐

6) What is your main activity?

Fishing ☐ Selling fish ☐ Stonemason ☐ Making coal ☐ Working at a shop ☐ Domestic ☐ ☐
Other ☐ Which?

7) How long have you lived in Maio?

Born in Maio ☐ < 5 years ☐ 5 to 10 years ☐ 10 to 20 years ☐ <20 years ☐

8) Of the following categories, which one represents your monthly salary?

< 11.000 cve / 11.000 – 20.000 cve / 20.000-30.000 cve / > 30.000 cve

Section B: Sociopsychological factors for present consumption behaviour

1) I am going to read a few phrases as if they were from your point of view, and I want you to choose the option that suits you the best. For example, if I dance *funana*, I feel happy

Completely agree : Agree : Don't agree or disagree : Disagree : Completely disagree

ATTITUDES

a) If I eat turtle next turtle season that would be

Very pleasant : Pleasant : Neither pleasant nor unpleasant : Unpleasant : Very Unpleasant

b) If I eat turtle next turtle season that would be

Very good: Good : Neither good nor bad : Bad : Very bad

c) If I eat turtle next turtle season that would be

Very valuable : Valuable : Neither valuable nor worthless : Worthless: Very worthless

SOCIAL NORMS

a) My family thinks that I should eat turtle next turtle neason

Completely agree : Agree : Don't agree or disagree : Disagree : Completely disagree

b) People similar to myself are going to eat turtle next turtle season

Completely agree : Agree : Don't agree or disagree : Disagree : Completely disagree

PERCEIVED BEHAVIOURAL CONTROL

a) If I really wanted to, next turtle season I could eat turtle

Completely agree : Agree : Don't agree or disagree : Disagree : Completely disagree

PERSONAL NORMS

a) If next turtle season I eat turtle, I will feel sad

Completely agree : Agree : Don't agree or disagree : Disagree : Completely disagree

b) Next turtle season it is my duty to not eat turtle

Completely agree : Agree : Don't agree or disagree : Disagree : Completely disagree

HABITS

a) Eating turtle is a tradition on Maio

Completely agree : Agree : Don't agree or disagree : Disagree : Completely disagree

INTENTIONS

a) Next turtle season I am going to try and eat turtle

Completely agree : Agree : Don't agree or disagree : Disagree : Completely disagree

b) If I feel the need, next turtle season I will eat turtle

Completely agree : Agree : Don't agree or disagree : Disagree : Completely disagree

Secção C: Sociopsychological factors for past consumption behaviour

1) Now I am going to read the same questions, but about 20 years ago, when there was no protection nor law.

ATTITUDES

a) 20 years ago, eating turtle was

Very pleasant : Pleasant : Neither pleasant nor unpleasant : Unpleasant : Very Unpleasant

b) 20 years ago, eating turtle was

Very good: Good : Neither good nor bad : Bad : Very bad

c) 20 years ago, eating turtle was

Very valuable : Valuable : Neither valuable nor worthless : Worthless: Very worthless

SOCIAL NORMS

a) 20 years ago, my family thought I should eat turtle

Completely agree : Agree : Don't agree or disagree : Disagree : Completely disagree

b) 20 years ago, people similar to myself ate turtle

Completely agree : Agree : Don't agree or disagree : Disagree : Completely disagree

PERCEIVED BEHAVIOURAL CONTROL

a) 20 years ago, if I really wanted to I could eat turtle

Completely agree : Agree : Don't agree or disagree : Disagree : Completely disagree

PERSONAL NORMS

a) 20 years ago if I ate turtle I felt sad

Completely agree : Agree : Don't agree or disagree : Disagree : Completely disagree

b) 20 years ago it was my duty to not eat turtle

Completely agree : Agree : Don't agree or disagree : Disagree : Completely disagree

HABITS

a) 20 years ago, eating turtle was a tradition on Maio

Completely agree : Agree : Don't agree or disagree : Disagree : Completely disagree

INTENTIONS

a) 20 years ago, I use to try and eat turtle

Completely agree : Agree : Don't agree or disagree : Disagree : Completely disagree

b) 20 years ago, if I felt the need, I would eat turtle

Completely agree : Agree : Don't agree or disagree : Disagree : Completely disagree

Only for the researcher:

Date / time: _____ / _____

Location where questionnaire was conducted: Morro / Calheta / Morrinho / Cascabulho / Praia Gonçalo / Santo António / Pedro Vaz / Alcatraz / Pilão Cão / Ribeira Dom João / Figueira / Barreiro

APPENDIX B
Supplementary tables

Table **S**1 – Reasoning behind the inclusion of sociodemographic variables in the questionnaire, based on data from semi-structured interviews

Sociodemographic variable	Reason for inclusion in analysis (based on interview data)
Gender	Men were said to be almost exclusively responsible for harvesting, which could in part translate to consumption.
Age	Younger adults were said to create networks in which to trade turtle meat more safely.
Settlement size	Participants attributed consumption to both smaller and larger settlements; the first because smaller and more remote communities are less conspicuous; the second because in larger communities with less familiar populations behaviours may go by unnoticed or unchallenged.
Geography (east/west)	Historically, eastern communities were reportedly more consumptive, but have recently been targeted with strong outreach initiatives.
Household size	People who live alone or with fewer household members were said to be more likely to engage in illegal behaviours, because they feel less exposed and likely to be caught.
Level of education	Less educated and environmentally aware people were mentioned as more prone to consume/harvest in the present.
Monthly salary	Unemployed or low-income earning men were blamed for current harvesting, as a way to make fast and easy money.
Time living on Maio	Foreigners and Cabo Verdeans that have returned from immigration were said to be less likely to consume turtles.

Table **S**2 **–** Recommendations about acceptable thresholds for commonly reported SEM fit indices (adapted from Schermelleh-Engel and Moosbrugger, 2003).

Measure	Name	Good fit	Acceptable fit
CFI	Comparative Fit Index	$.97 \leq CFI \leq 1$	$.95 \leq CFI < .97$
TLI	Tucker-Lewis Index	$.97 \leq TLI \leq 1$	$.95 \leq TLI < .97$
RMSEA	Root Mean Square Error of Approximation	$0 \leq RMSEA \leq .05$	$.05 < RMSEA \leq .08$
SRMR	Standardized Root Mean Square Residual	$0 \leq SRMR \leq .05$	$.05 < SRMR \leq .10$
***p*-value**	Chi square significance test	$.05 < p \leq 1$	$.01 \leq p \leq .05$
χ^2/df	Chi-square value / degrees of freedom	$0 \leq \chi^2/df \leq 2$	$2 < \chi^2/df \leq 3$

Note: Sample size directly affects the χ^2 value. The sensitivity of this index to the sample size has raised some well-founded reservations that have led to the emergence of other complementary goodness-of-fit indices (Gana and Broc 2019: 29)

Table **S**3 **–** Monetary values of several products deriving from illegal turtle trade, in the past and present on different Cabo Verde islands or internationally. These were compiled from over a dozen independent accounts found in survey field notes.

Location	Period	Product	Value (CVE)	Value (USD)
Maio	~20 years ago	1kg turtle meat	150$00 – 250$00	US$1.61 – US$2.69
Maio	Present	1kg turtle meat	300$00 – 800$00 average 450$00	US$3.23 – US$8.61; average US$4.84
Maio	Present	Whole turtle	5000$00 – 8000$00	US$53.78 – US$86.05
Maio	Present	Turtle penis	2000$00 – 2500$00	US$21.51 – US$26.89
Maio	Present	Green turtle shell	2000$00	US$21.51
Praia	Present	Small plate of turtle meat	300$00 – 500$00	US$3.23 – US$5.38
Praia	Present	Plastic cup with turtle meat	300$00	US$3.23
Praia	Present	Whole turtle	17.000$00 – 20.000$00	US$182.86 – US$215.13
Praia	Present	Turtle penis	4000$00	US$43.03
S. Vicente	~20 years ago	1kg turtle meat	600$00	US$6.45
S. Vicente	Present	1kg turtle meat	1000$00	US$10.76
Europe	Present	Turtle penis	10.000$00 – 15.000$00	US$107.56 – US$161.35

Table **S**4 **–** Summary of categorical and continuous sociodemographic variables included in consumption intention analysis.

Categorical variables	**Level**	**Count (%)**	**Missing data (%)**
Sex	Female	203 (62.5)	0
	Male	122 (37.2)	
Age group	18 – 24	30 (9.2)	1 (0.003)
	25 – 34	58 (17.8)	
	35 – 44	68 (20.9)	
	45 – 54	72 (22.1)	
	> 55	96 (29.5)	
Level of education	Cannot read or write	53 (16.3)	0
	1^{st} – 4^{th} year	89 (27.4)	
	5^{th} – 9^{th} year	130 (40)	
	10^{th} – 12^{th} year	36 (11.1)	
	University or higher	17 (5.2)	
Settlement size	Small	87 (26.7)	0
	Medium	177 (54.5)	
	Large	62 (18.8)	
Settlement geography	East	173 (53.2)	0
	West	152 (46.8)	
Monthly salary (CVE)	No salary	176 (54.2)	18 (5.5)
	< 11$000	48 (14.7)	
	11$000 – 20$000	57 (17.6)	
	> 20$000	26 (8)	
Years living in Maio	Born in Maio	266 (81.8)	0
	More than 20 years	30 (8.9)	
	Less than 20 years	29 (9.3)	

Continuous variables	**Median**	**S.D**	**Min**	**Max**	**Missing data (%)**
Household size	4	1.78	1	10	1 (0.003)

Table **S**5 **–** Model fit estimates for present/past measurement models, latent growth models of attitudes and intention, and measurement models for invariance across geography, household groups and time. LGM = Latent Growth Model; ATT = Attitudes; INT = Intention; CFI = Comparative Fit Index; TLI = Tucker Lewis Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardized Root Mean Residual; χ^2 = Chi-square value; df = degrees of freedom.

Model	CFI	TLI	RMSEA	SRMR	p-value	χ^2/df	χ^2(df)
Present	.984	.969	.056	.040	.004	1.845	53.500 (29)
Past	.970	.944	.094	.065	< .000	4.195	121.655 (29)
LGM ATT	.999	.999	.011	.020	.418	1.030	15.468 (15)
LGM INT	1.00	.998	.016	.022	.310	1.197	4.789 (4)
Geographic invariance							
Configural	.982	.965	.089	.025	< .000	2.165	125.584 (58)
Metric	.982	.969	.085	.031	< .000	2.070	130.435 (63)
Scalar	.983	.972	.080	.030	< .000	1.963	133.516 (68)
Residual	.985	.979	.069	.030	< .000	1.638	126.160 (77)
Household invariance							
Configural	.971	.945	.112	.040	< .000	2.422	210.707 (87)
Metric	.972	.953	.104	.043	< .000	2.190	212.426 (97)
Scalar	.969	.953	.104	.044	< .000	2.190	238.131 (107)
Residual	.967	.956	.100	.048	< .000	1.976	246.960 (125)
Time invariance							
Configural	0.974	0.951	0.081	0.051	< .000	1.863	108.08 (58)
Metric	0.972	0.951	0.081	0.059	< .000	1.861	117.21 (63)
Scalar	0.964	0.942	0.088	0.056	< .000	2.023	137.59 (68)
Residual	0.793	0.692	0.202	1.501	< .000	6.511	481.84 (74)

APPENDIX C

Code system used for interview transcripts and field notes

1. Motivations
   - 1.1. Harvesting
     - 1.1.1. Past
       - 1.1.1.1. "*Casa farte*" (To fill the house with food)
       - 1.1.1.2. Consumption
       - 1.1.1.3. Artisanal
       - 1.1.1.4. Selling
     - 1.1.2. Present
       - 1.1.2.1. To sell
   - 1.2. Consumption
     - 1.2.1. Past
       - 1.2.1.1. Medicinal
       - 1.2.1.2. Delicious taste
       - 1.2.1.3. Lack of food / resources
     - 1.2.2. Present
       - 1.2.2.1. Lack of food / resources
       - 1.2.2.2. Delicious taste
       - 1.2.2.3. Lack of food is NOT a reason

2. Description of consumption
   - 2.1. Past
     - 2.1.1. When did turtle protection start?
   - 2.2. Present
     - 2.2.1. Importance of raising awareness
     - 2.2.2. Strategies to cook turtle differently

3. Description of harvesting
   - 3.1. Past
     - 3.1.1. By boat
     - 3.1.2. Quantity of harvest
   - 3.2. Present

4. *Burgatxo* (turtle penis)
   - 4.1. Reason for usage

5. Why is it important to protect turtles?
   - 5.1. Raising turtles at home

6. Description of community
   - 6.1. Past
   - 6.2. Present

7. Geography
   - 7.1. West
   - 7.2. East
   - 7.3. Communities with more harvest / consumption

8. Survey notes
   - 8.1. Comments about past harvesting / consumption
   - 8.2. Immigrant's thoughts
   - 8.3. Prices
   - 8.4. Awareness being raised
   - 8.5. Comments about present harvesting / consumption
     - 8.5.1. Turtles are overprotected
     - 8.5.2. It cannot be a necessity
     - 8.5.3. Turtles now and in the past (taste, size, smell)
     - 8.5.4. Motivations
     - 8.5.5. Cooking turtles and their smell

1 Motivations
Motivations for either harvesting or consuming turtles, in both the past and present.

1.1 Harvesting
Motivations for harvesting

1.1.1 Past
Motivations for harvesting in the past

1.1.1.1 "*Casa farte*" (To fill the house with food)
Dialogue concerning the trade of turtle meat and products for a variety of other goods with the community, mainly rice, corn, potatoes, other meat and food in general, resulting in a "house filled with food"/*casa farte.*

1.1.1.2 Artisanal
Codes pertaining to the uncommon artisanal use of turtle shells in the past.

1.1.1.3 To sell
Excepts about the trade of turtle products in exchange for money, infrequent in the past.

1.1.2 Present
Motivations for harvesting in the present

1.1.2.1 To sell

Discourse about current turtle product trade, mainly consisting of meat, shells and penis.

1.2 Consumption
Motivations for consumption

1.2.1 Past
Motivations for consumption in the past

1.2.1.1 Medicinal
Rare mentions of the medicinal use of turtle parts, excluding the aphrodisiac penis.

1.2.1.2 Delicious taste
Statements about the excellent taste of turtle meat, fat, eggs and organs, from the past.

1.2.1.3 Lack of food/resources, poverty
Exchanges about the lack of available foods and general poverty that occurred in the past as a driver of turtle consumption.

1.2.2 Present
Motivations for consumption in the present

1.2.2.1 Lack of food/resources, poverty
Exchanges about the lack of available foods and poverty that some people may experience in the present, which drives turtle consumption.

1.2.2.2 Delicious taste
Codes concerning the excellent taste of turtle meat, fat, eggs and organs, in the present.

1.2.2.3 Lack of food is NOT a reason
Remarks made about lack of food and poverty not being a possible motivation for turtle consumption in the present, due to the societal changes on the island (better infrastructures, job availability, government assistance, etc.).

2 Description of consumption
A variety of descriptions, discussions, stories, beliefs and perceptions regarding turtle consumption.

2.1 Past
Accounts of how turtle parts were used, prepared and cooked in a different ways and of the people who ate/used them.

2.1.1 When did turtle protection start?
Assertions of when turtle protection started, as understood by participants, ranging from the 1980s to only a couple of years ago.

2.2 Present
Dialogue about aspects of present turtle meat consumption.

2.2.1 Importance of raising awareness
Thoughts about awareness efforts undertaken in the recent past/present to inform people about turtle importance.

2.2.2 Strategies to cook turtle differently
Descriptions of different strategies people use nowadays to furtively eat turtles, either relating to how to actually cook the meat differently or where and when it should be cooked in order to avoid detection

3 Description of harvesting
A variety of descriptions, discussions, stories, beliefs and perceptions regarding turtle harvesting.

3.1 Past
Depictions of the process of harvesting turtles on the beach in the past.

3.1.1 By boat
Practical details of how fishermen caught turtles by boat, during their daily fishing activities.

3.1.2 Quantity of harvest
Accounts concerning estimates of the amount of turtles harvested in each community, be it weekly, monthly or seasonally.

3.2 Present
Descriptions of present poaching/harvesting of turtles, along with strategies and differences compared to the past.

4 *Burgatxo* (turtle penis)
Sections concerning turtle penises (*burgatxos*), how they were collected, treated, consumed and sold.

4.1 Reason for usage
Accounts of the reasons for consuming turtle penis

5 Why is it important to protect turtles?
Opinions and values regarding why turtles should be protected instead of consumed.

5.1 Raising turtles at home
Very specific reports about locals can raise recently hatched turtles at home in a tank, in order to protect them during their most vulnerable stage.

6 Description of community

Details about Maio communities.

6.1 Past
Descriptions of how communities or Maio as a whole use to be approximately 15 years ago, its people, what activities or jobs were performed, how life was in general.

6.2 Present
Descriptions of how communities or Maio are currently, mainly what positive or negative things have changed since the past.

7 Geography
Codes relating to community geography

7.1 West
Codes that identify western community transcripts.

7.2 East
Codes that identify eastern community transcripts.

7.3 Communities with more harvest/consumption
Information about which communities were, or continue to be, those that harvest/consume the most turtles.

8 Survey notes
Separate code system for notes taken during surveys. Many of these categories relate directly to interview categories, while others are distinct and were novel.

8.1 Comments about past harvesting/consumption
Relevant comments made about harvesting or consumption of turtles in the past.

8.2 Immigrants' thoughts
Notes and opinions on what immigrants think about current turtle harvesting/consumption.

8.3 Prices
Prices or estimates given by participants about turtle product values in the past and present.

8.4 Awareness being raised
Notes related to the existence/absence of awareness about turtle protection, and its importance.

8.5 Comments about present harvesting/consumption
General remarks about current harvesting/consumption.

8.5.1 Turtles are overprotected
Comments made about turtles being more protected and valued than people.

8.5.2 It cannot be a necessity
Assertions about how consuming turtle meat is no longer a necessity.

8.5.3 Turtles now and in the past (taste, size, smell)
Instances where participants declared turtles are now not as tasty, healthy or the same size as in the past, due to a variety of factors.

8.5.4 Motivations
Motivations given for present turtle harvesting/consumption.

8.5.4.1 Cooking turtles and their smell
Comments about the how turtle meat must be cooked differently due to its distinctive strong smell.